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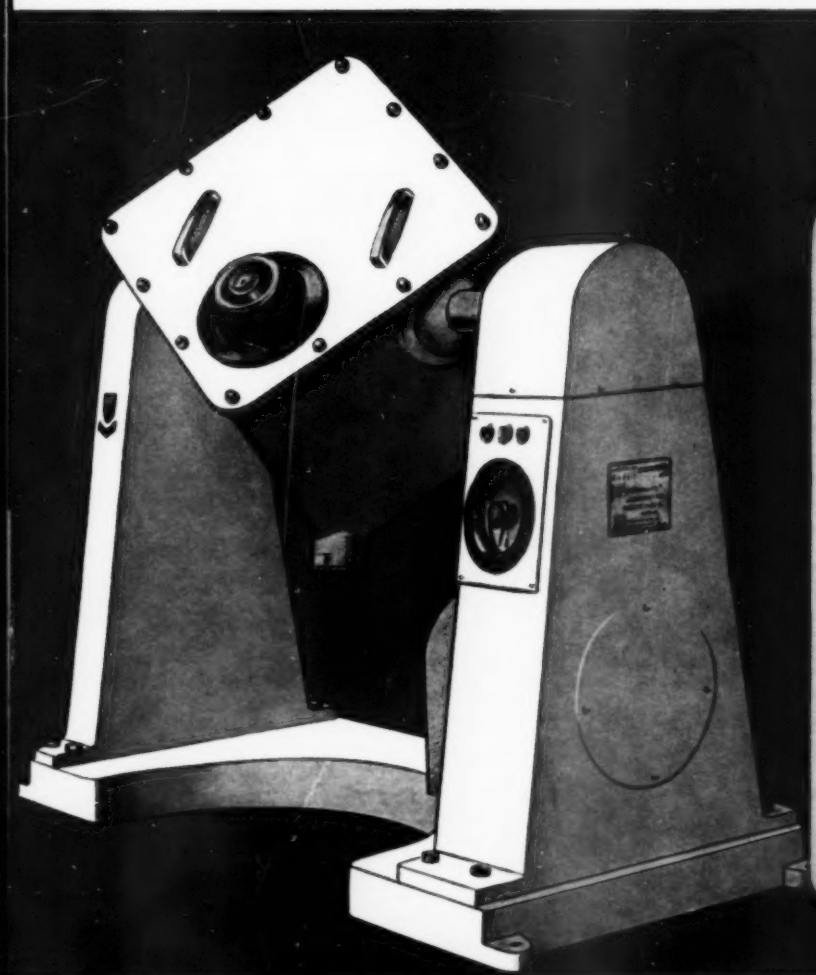
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Vol. XXXII No. 6

JUNE 1961



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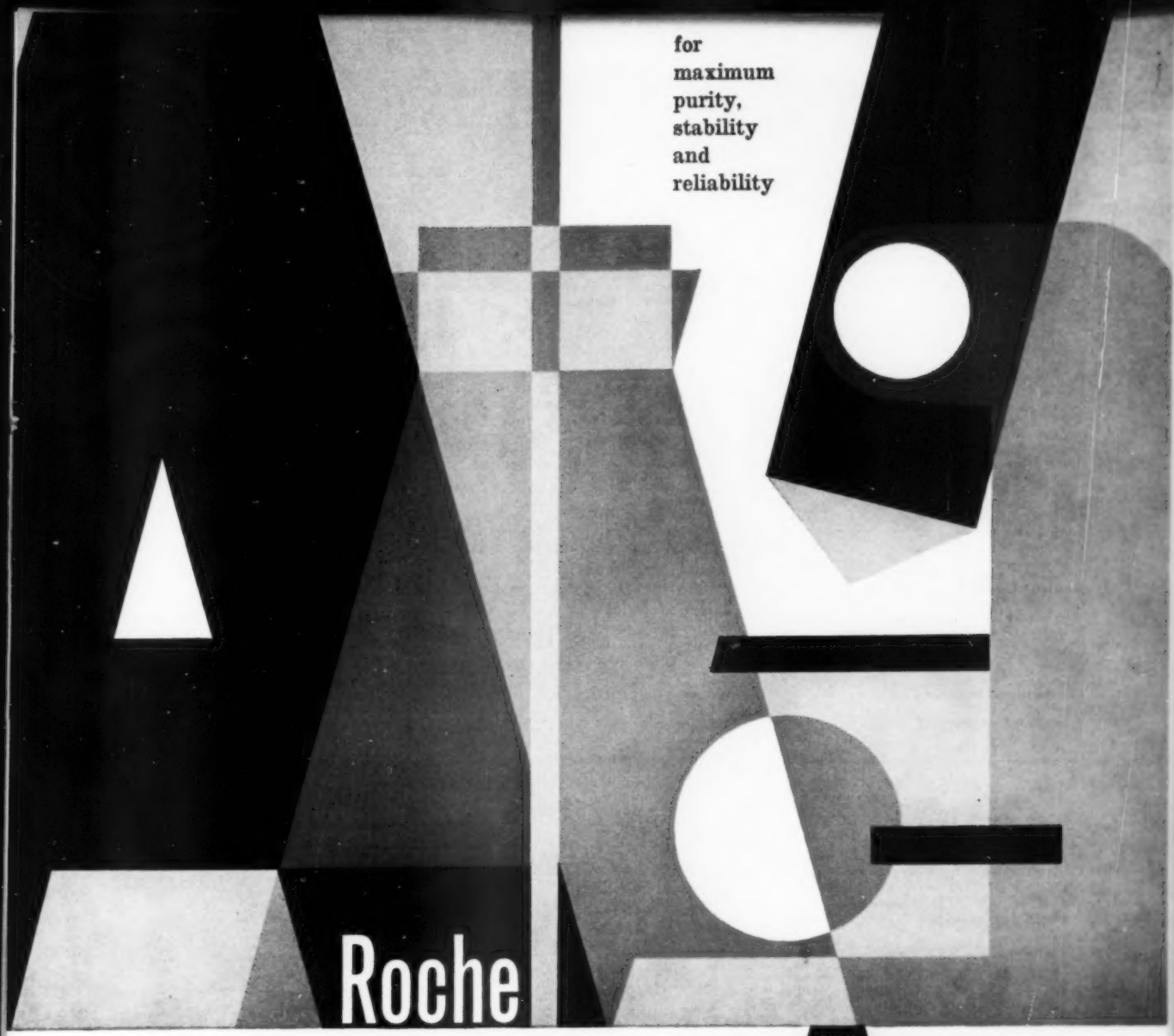
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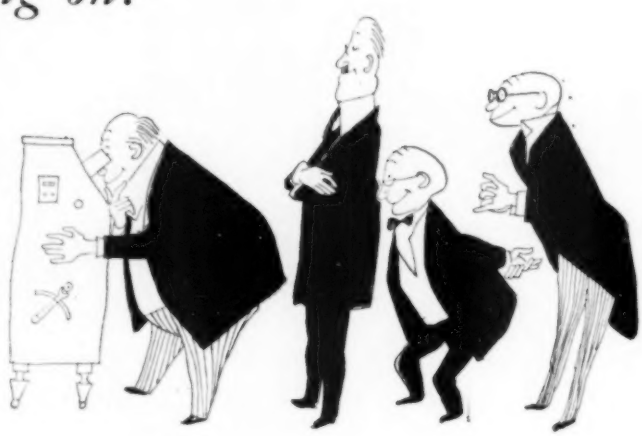
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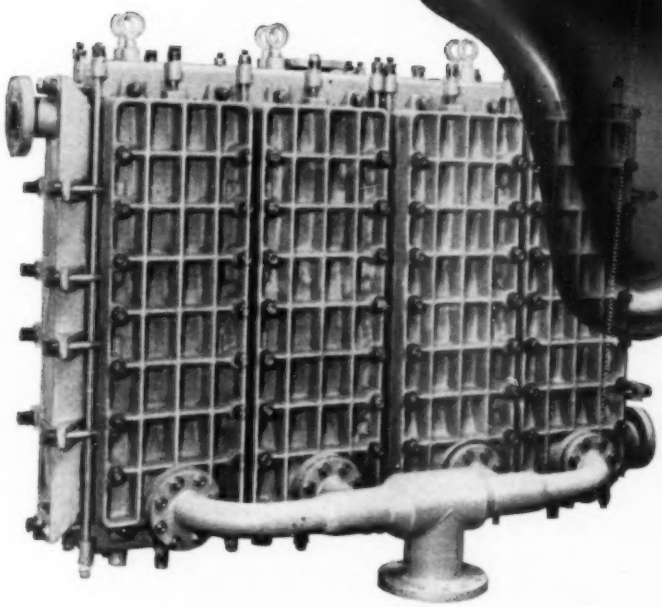
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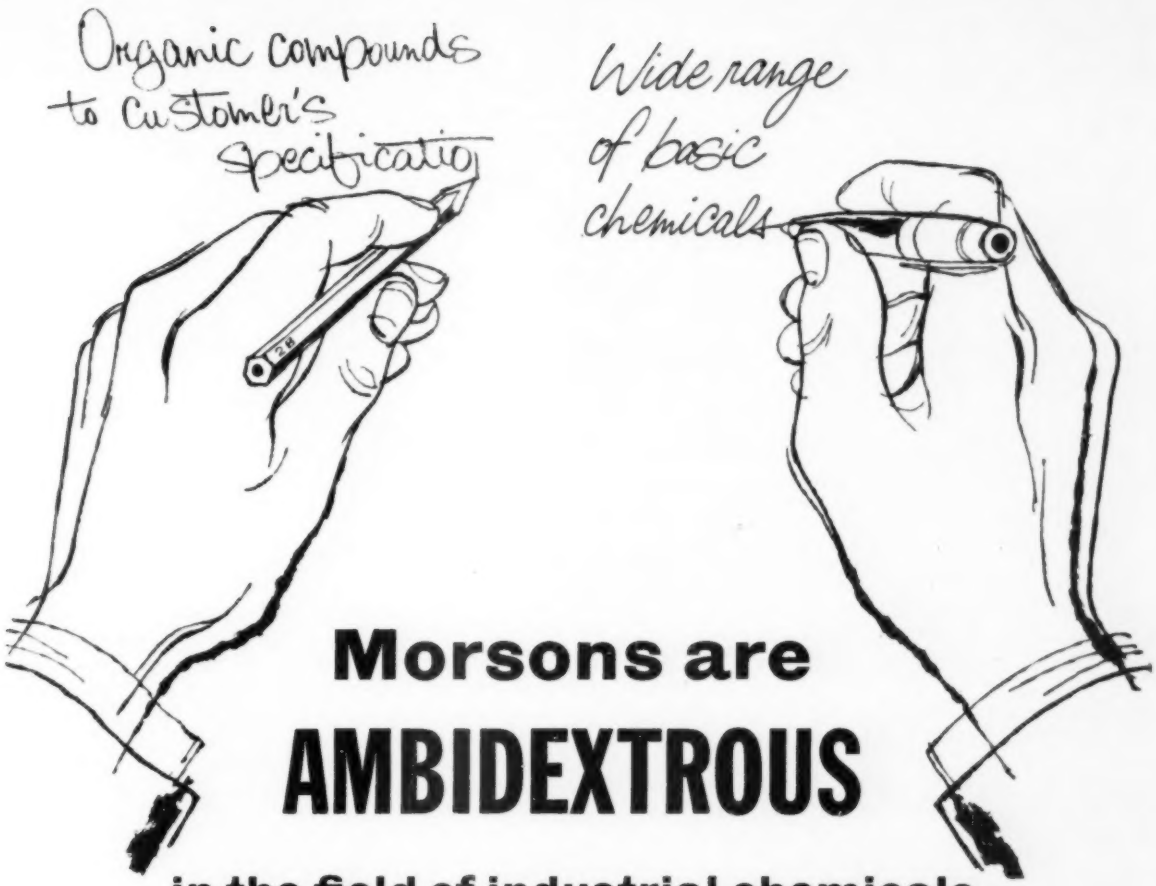
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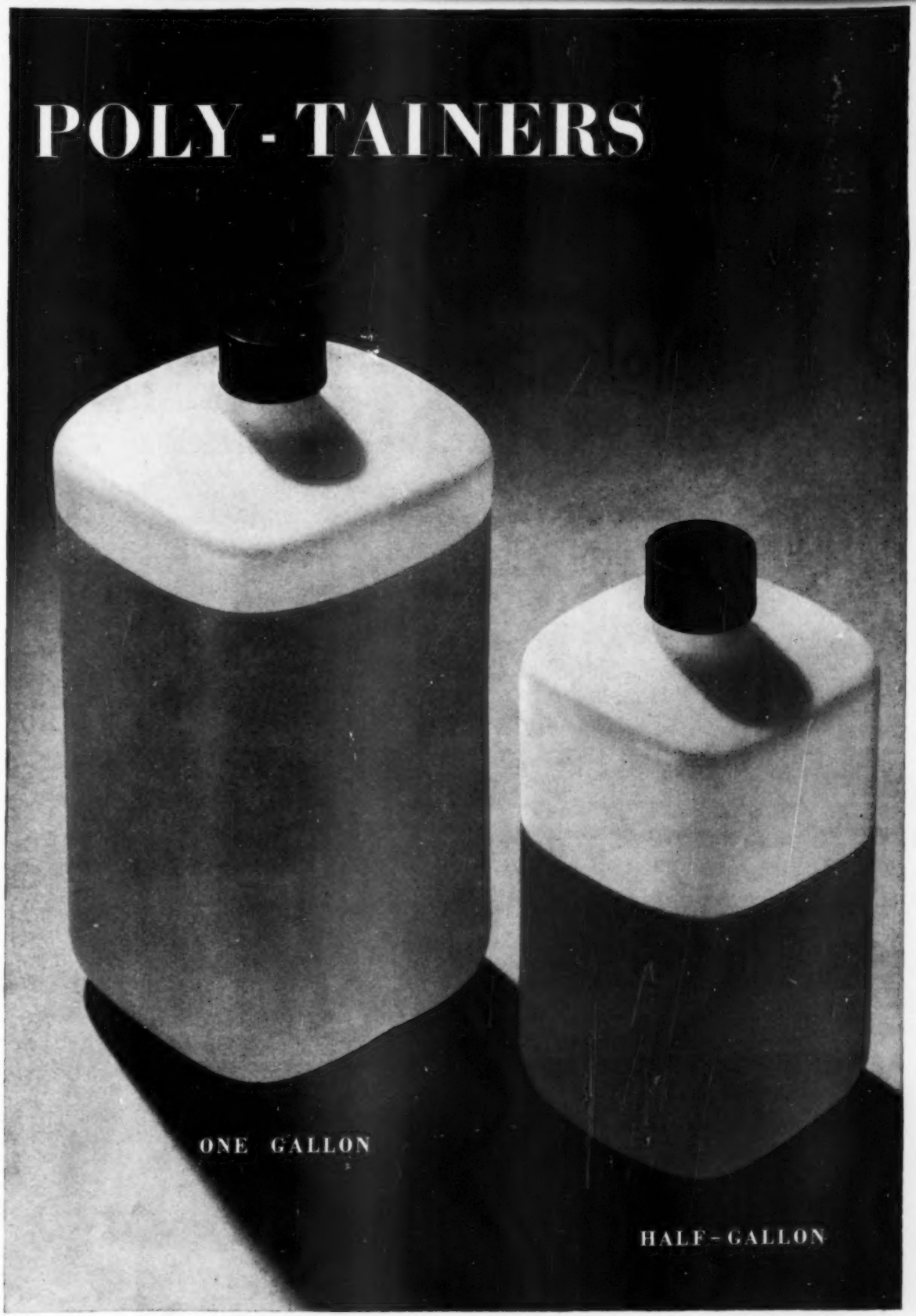
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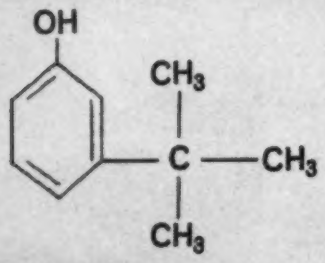
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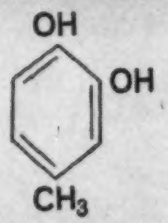
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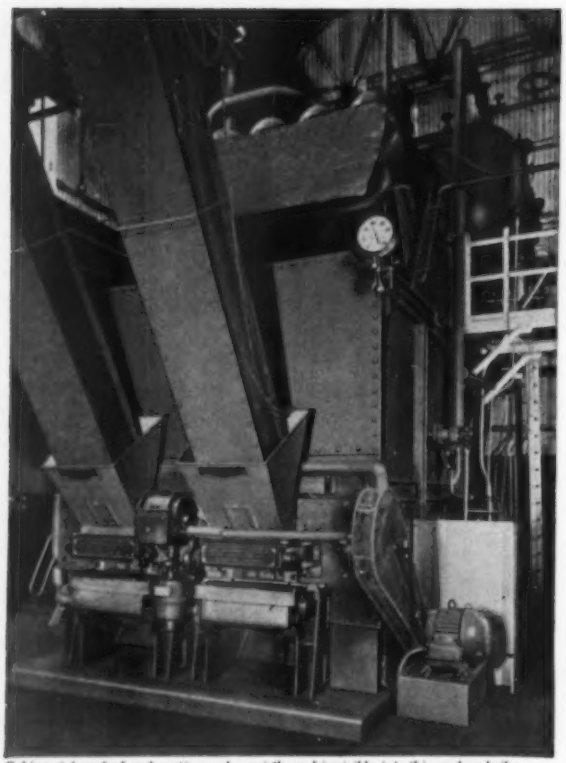
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VENESTA FOILS LIMITED

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COAL—properly used—is the cheapest fuel for the Chemical Industry



Coking stokers feed coal continuously, quietly and invisibly into this modern boiler.

Search the industrial scene—and it is difficult to find any major industry that does not use chemicals. But even in the prospering chemical and chemical processing world, sound economics are of primary importance and wise managements will always make every possible saving and every possible improvement that will help keep prices stable while satisfying—and expanding—their home and overseas markets.

BEGIN AT THE BEGINNING—THE BOILERHOUSE

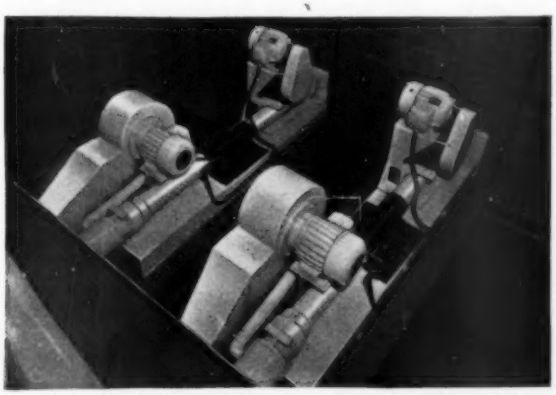
There are still some chemical plants that handicap their finances with outdated boilerhouses. To modernise other machinery while 'making-do' with inefficient boilers is to throw good money down the drain. Modern coal-burning installations can be so efficient that they will more than pay for themselves in a remarkably short time. They are, without question, the *first* essential in a chemical plant that is going to make rising profits for its management.

COAL IS THE RELIABLE FUEL

One question for any long-term planning is obvious: can supplies of coal be guaranteed? The answer is yes—without qualification. The mining industry—Britain's *largest single industry* is becoming increasingly efficient; its equipment is the best of its kind. And British coalfields contain enough coal to supply every industrial demand for centuries to come.

COAL IS CLEANER, HOTTER

Modern grading and washing methods ensure that coal is the most efficient and consistent fuel for every type of boiler—the ideal fuel for every section of the chemical and chemical processing industry. But to obtain the maximum heat at the lowest cost, coal should be mechanically stoked. A mechanical stoker automatically feeds the right amount of coal for the boiler load even when the load is varying; it burns coal at optimum efficiency all the time without the emission of smoke; and it virtually replaces the human element in boiler operation. There are many types of mechanical stokers, of which the most commonly used are the Chain Grate stoker, the Coking stoker, the Underfeed stoker and the Sprinkler stoker. Standard models are available for all sizes of boiler.



Two underfeed stokers feeding coal direct from a storage hopper into a modern vertical boiler.

OVER 80% OF BRITISH INDUSTRY USES COAL

The National Coal Board is determined that COAL shall continue to be plentiful, shall continue to keep our industrial power both dominant and progressive. You can depend upon COAL; its sources and supply are in our *own* hands, free from the fluctuations of foreign policies. Endless research by scientists and chemists working in the laboratories of the N.C.B. will ensure that coal will be increasingly profitable for its users.



DELIVERY—ON THE DOT —ON THE SPOT

The delivery of coal is today highly organised and completely reliable. Leading coal merchants have completely overhauled delivery and storage systems and are fully equipped to make sure that you get the right grade of coal when you want it and where you want it. And handling can be fully automatic. Furthermore, completely mechanised handling systems will transport coal from storage to furnace without any manual labour at all.

AND—WHEN YOU NEED IT— A NATION-WIDE FREE SERVICE

The vast resources of the National Coal Board are no further away than your telephone. At a flick of your finger, you can call upon one of the most comprehensive and efficient technical services in the world. No problem is too small or too big. You may want advice on coal quality, coal storage or coal-burning appliances or even on the siting of a new boilerhouse—whatever it is, a 'phone call or letter either to your coal supplier or to the Regional office of the National Coal Board will bring an authoritative answer to your problem.

FINANCE PLAN FOR INDUSTRY

No deposit, repayments spread over five years, low interest charges that can be set against Tax, full investment and other capital allowances, that can be claimed at once, these are the terms available to the manufacturer or businessman who wants to install modern coal-burning equipment without touching his capital resources.

Make use of the National Coal Board Industrial Finance Plan. The loans are made by Forward Trust Limited, who are members of the Midland Bank Group. A 'phone call or a letter to the Regional office of the National Coal Board will bring you full details.

SOLID FUEL—more heat at less cost—and it's British

PROGRESSIVE INDUSTRY IS GOING FORWARD ON COAL

ISSUED BY THE NATIONAL COAL BOARD

And now

available for the first time

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Bedford light van

with diesel power

FIRST CHOICE FOR THE HIGH MILEAGE OPERATOR

THE NEW Bedford diesel vans now join the famous family of petrol-engined models. Power unit is the well-proved Perkins 4/99 diesel—simple, dependable, economical. This modern, high-speed diesel develops maximum power at 3,600 r.p.m.; presents a lively turn of speed, first class acceleration and hill-climbing.

It is installed on the Bedford assembly line as a regular production unit, and prices thus reflect the economies made possible by large volume manufacture.

First-class service and low-price parts are available everywhere through Bedford dealers. Ask your local Bedford dealer for full details and a demonstration.

Better buy Bedford

Vauxhall Motors Limited, Luton, Bedfordshire.



Top value for money in dependable diesel transport.

	10/12 cwt.	15 cwt.
90″ wheelbase chassis	£480	£490
102″ wheelbase chassis	£490	£500
90″ wheelbase van	£580	£590
102″ wheelbase van	£600	£610

200,000×8 years proof. Behind the new Bedford diesel is the reliability that comes from building more than 200,000 petrol-engined vans to a sound basic design developed and improved over 8 years.

All prices include spare wheel and tyre.

Ethylene Glycol anti-freeze

For premium grade anti-freeze order Union Carbide* ethylene glycol to the following specifications: Uninhibited—BS 2537

Inhibited—BS 3150, 3151, 3152

or to your own specified inhibitor system.

UNION CARBIDE

Union Carbide ethylene glycol is available in road tankers or drums.



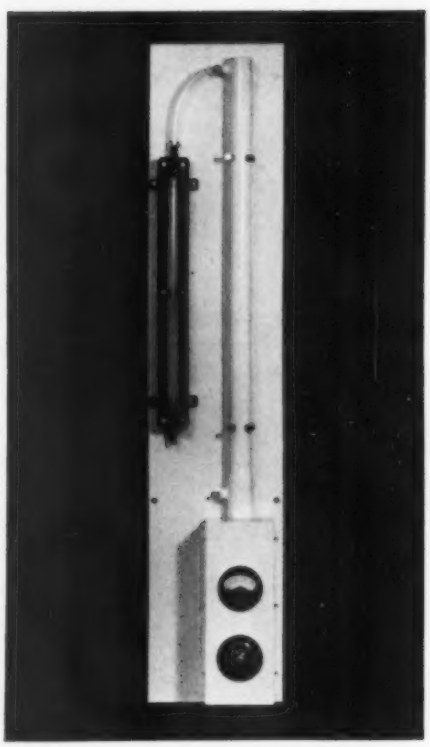
*The term UNION CARBIDE is a trade mark of UNION CARBIDE CORPORATION

UNION CARBIDE LIMITED · CHEMICALS DIVISION · 8 GRAFTON STREET · LONDON W1 · MAYFAIR 8100

CBC/UCC69



$X + O_3 = ?$



Ozone as a powerful oxidizing agent has specific advantages when compared with other chemical oxidents. Particularly ease of control with no materials handling problems with operating costs constant and predictable.

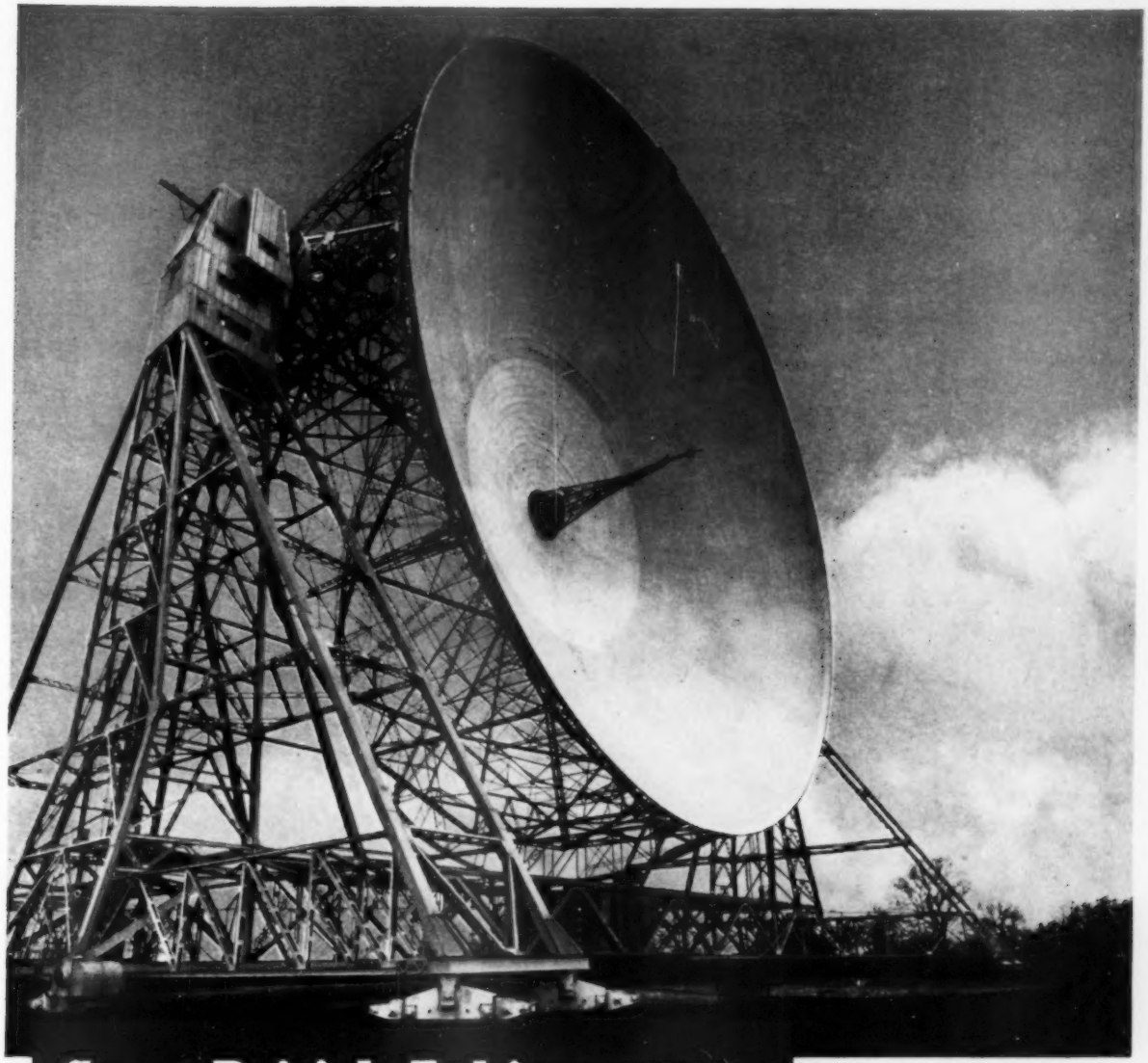
Ozone in the laboratory

Useful savings in research can be effected by the installation of an E.C.D. ozone generator specially designed as a precision laboratory instrument. Like other E.C.D. products 'Ozono' Generators for laboratory use are 'tailor made' to meet individual requirements and provide safe dependable equipment for the production of Ozone where measured accuracy is essential.

E.C.D. Ltd., Engineers, Tonbridge, Kent

Tel: Tonbridge 2237 (3 lines) Grams: Tonmil, Tonbridge.

One of the Wallace & Tiernan Group of Companies.



Great British Achievements

Acknowledgements to Husband & Co., Consulting Engineers.

the Radio Telescope at Jodrell Bank.....

The Wellsian look of the radio telescope at Jodrell Bank is appropriate to its task—tracking artificial satellites and measuring signals that come out of the sky as radio waves. Britain has the credit of building this new link with the Universe.

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Fork Lift Trucks fuelled by BOTTOGAS Butane



Photograph by courtesy of Priory Meux Ltd.

BOTTOGAS

BUTANE

PRECISION FUEL for mechanical handling

Fork Lift Trucks fuelled by BOTTOGAS butane operate safely indoors. This Precision Fuel means safety for personnel and goods, less engine maintenance, greater efficiency and economy.

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BOTTOGAS butane and PROPAGAS propane come from the British Refineries of the Shell and BP Groups. They are backed by a nation-wide distribution service and technical resources second to none.

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Show us the product -

we will produce the lamination

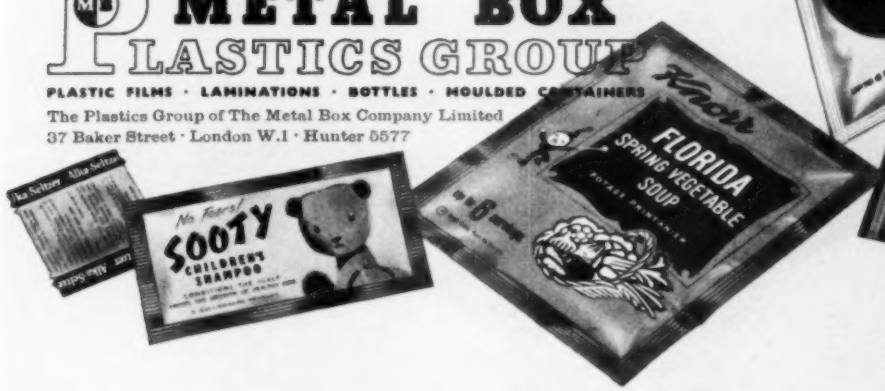
You can rely on Metal Box to find the one lamination that is really suited to your product—or to give you a choice, where that is possible. Sales appeal, maximum protection, machine handling properties are all most carefully considered. How is it done? Firstly by discussing the project with the trained and experienced field service men representing Metal Box Research. Behind these on-the-spot men there is the whole of Metal Box Research Division where the stored experience of many years often produces the quick answer to your *need;* or where the laboratories can reproduce all the conditions your pack is likely to meet. Whether it is six months in the jungle or twelve in the Antarctic—Metal Box can tell you how your pack is likely to behave. With the right material selected from the fully comprehensive Metal Box range there is in addition the design service to assist, and where appropriate a market information service too. Call in a Metal Box Plastics Group representative, for a 'start to finish' service—
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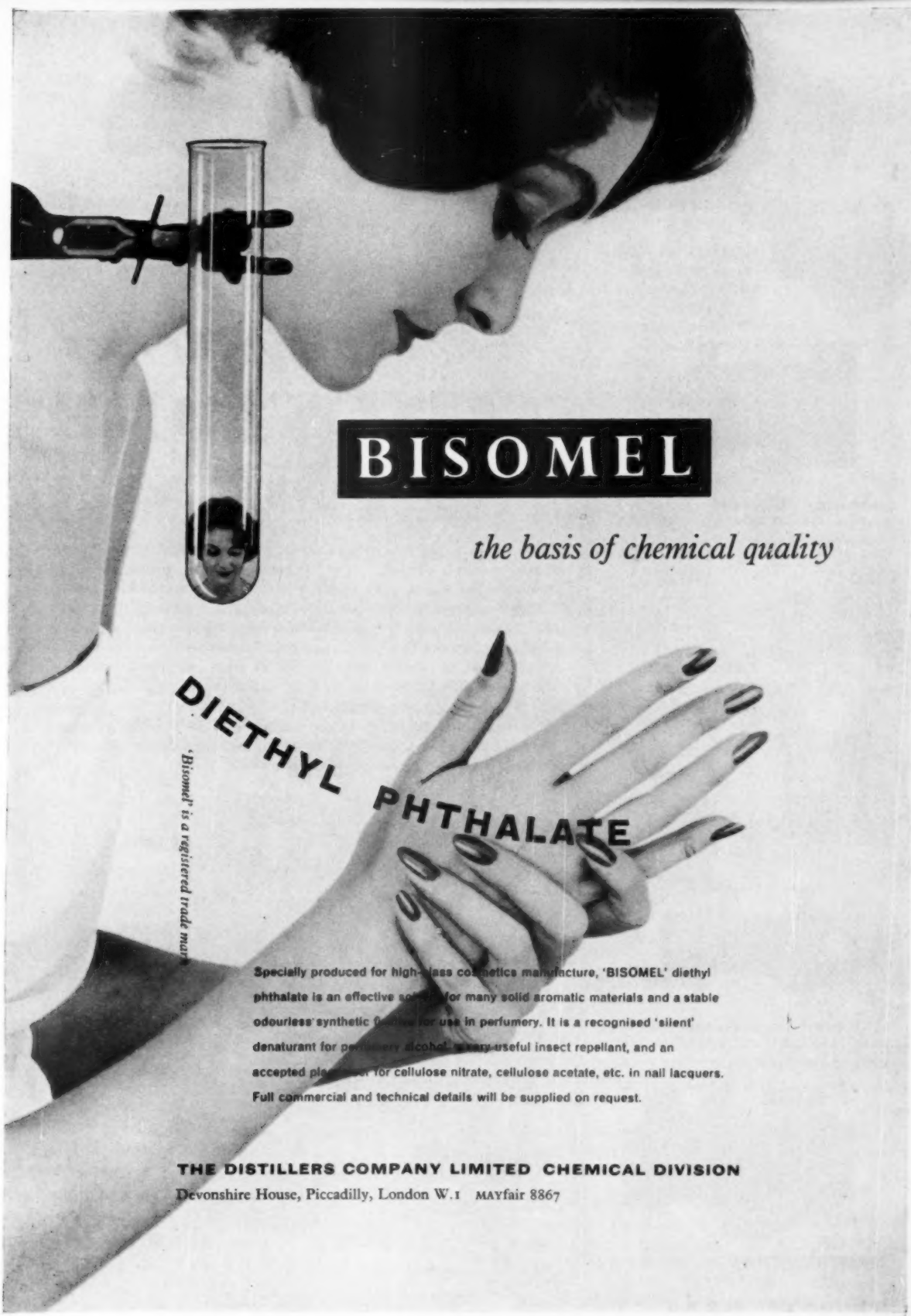
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Years of experience . . . large-scale production . . . ample stocks . . . rigid quality control—these are a few of the reasons why many companies now entrust us with all their Opiates requirements. We like to think also that the personal touch we are able to maintain has something to do with it. The following are selected from our comprehensive list of opiates:

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HYDROCODONE BITARTRATE
OXYCODONE HYDROCHLORIDE
NARCOTINE HYDROCHLORIDE
ETHYLMORPHINE HYDROCHLORIDE

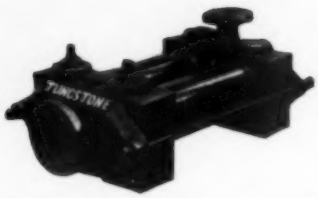
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Specially produced for high-class cosmetics manufacture, 'BISOMEL' diethyl phthalate is an effective solvent for many solid aromatic materials and a stable odourless synthetic fixative for use in perfumery. It is a recognised 'silent' denaturant for perfumery alcohol, a very useful insect repellant, and an accepted plasticiser for cellulose nitrate, cellulose acetate, etc. in nail lacquers. Full commercial and technical details will be supplied on request.
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NICKEL/CAST IRON—10 sizes, 375 to 9,000 galls./hr. (Rubber lined—in 8 sizes, 800 to 9,000 galls./hr.)



EBONITE PUMP non-immersion type. Made in 3 sizes: 200, 375, 600 gallons/hour.

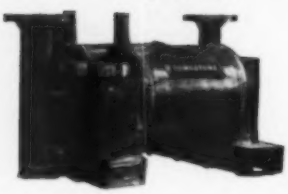
Troublesome Liquids need

TUNGSTONE PUMPS

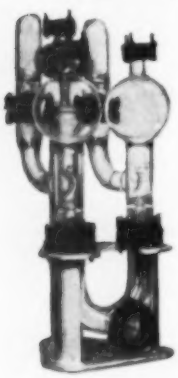
Which particular liquid in your business presents its pumping problem? Is it an acid, a slurry, a sludge . . . gritty greasy, corrosive, erosive, sticky? A TUNGSTONE Pump will quickly take care of that—as many industries have proved.

These fine pumps specially evolved for the handling of 'awkward' liquids have two valuable features: (a) the unit can be supplied in a range of materials which resist corrosion by any particular liquid, (b) there are no packings or glands within the unit and there is nothing to clog or choke—air is used as a piston, although it never mixes with the liquid: maintenance costs are negligible.

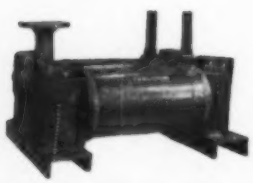
For any given pumping pressure the volume of air going to the pump can be controlled so that the pump's output can be varied from zero to maximum. The pump and whole length of delivery pipe containing valuable liquid can be emptied after each operation at the end of a shift.



non-immersion LEAD PUMP. Made in 8 capacities: 375, 600, 800, 1,200, 1,500, 2,000, 3,000, 3,600 gallons/hour.



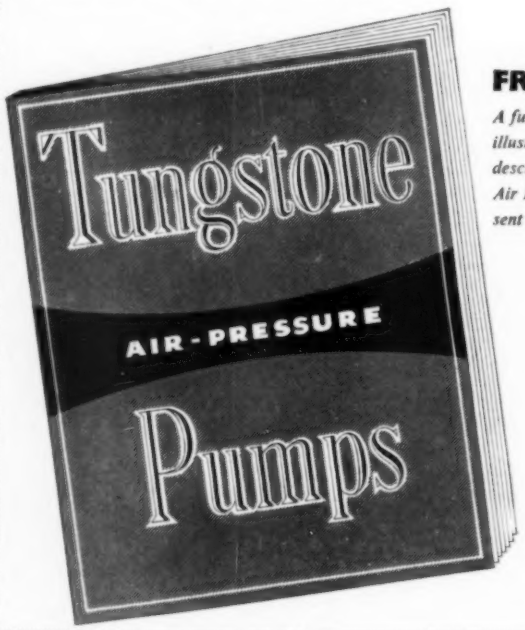
GLASS PUMP—"Pyrex" brand Borosilicate Glass. 300 gallons/hour.



LEAD PUMP—immersion type. Made in 8 capacities: 375, 600, 800, 1,200, 1,500, 2,000, 3,000, 3,600 gallons/hour.



EBONITE PUMP, immersion type. Made in 3 sizes: 200, 375, 600 gallons/hour.



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GIV-TAN® F

GIV-TAN F (Patent Pending) is a new sunscreening agent developed by our research laboratories to increase the efficiency and sales appeal of your suntan product. It enables you to provide maximum sunburn protection—and the deep, lasting, bronze-like tan your customers want—at savings up to 50%!

GIV-TAN F is easy to use. Being a miscible oil, it dissolves and mixes readily in all media normally employed for sunscreen preparations. As an oil it offers special qualities that enhance the cosmetic elegance of your product.

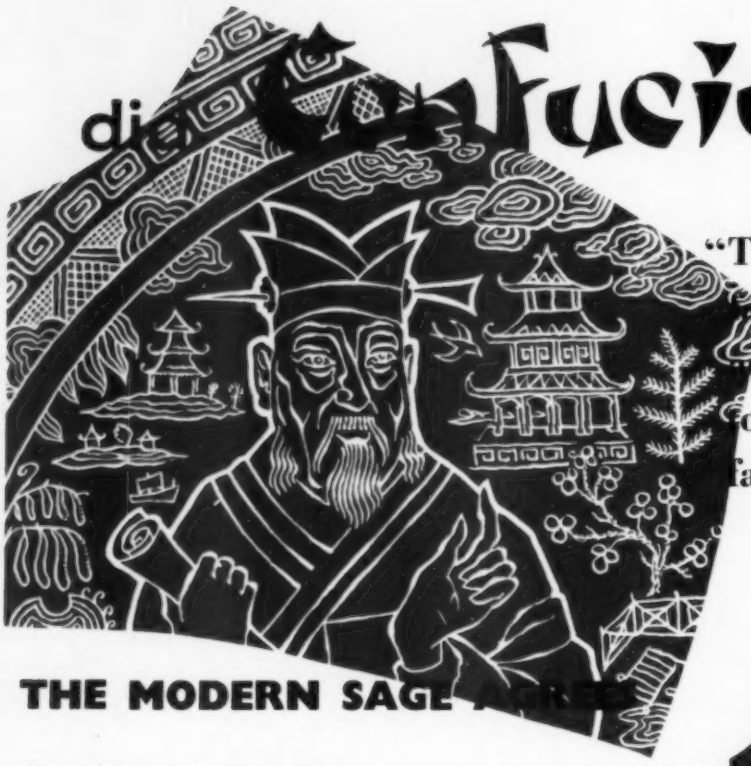
GIV-TAN F is stable in solution and under exposure to sunlight . . . proved in field and laboratory tests . . . harmless to fabrics . . . non-irritating to the skin. It is extremely economical in any type of suntan preparation or sunburn preventive—in hydro-alcoholic solutions, oils, lotions, creams and other products.

GIV-TAN F is not an aminobenzoate nor does it contain other reactive groups and therefore is compatible with dihydroxyacetone.

GIVAUDAN
& Co. Ltd.
WHYTELEAFE, SURREY
Upper Warlingham
2241/5

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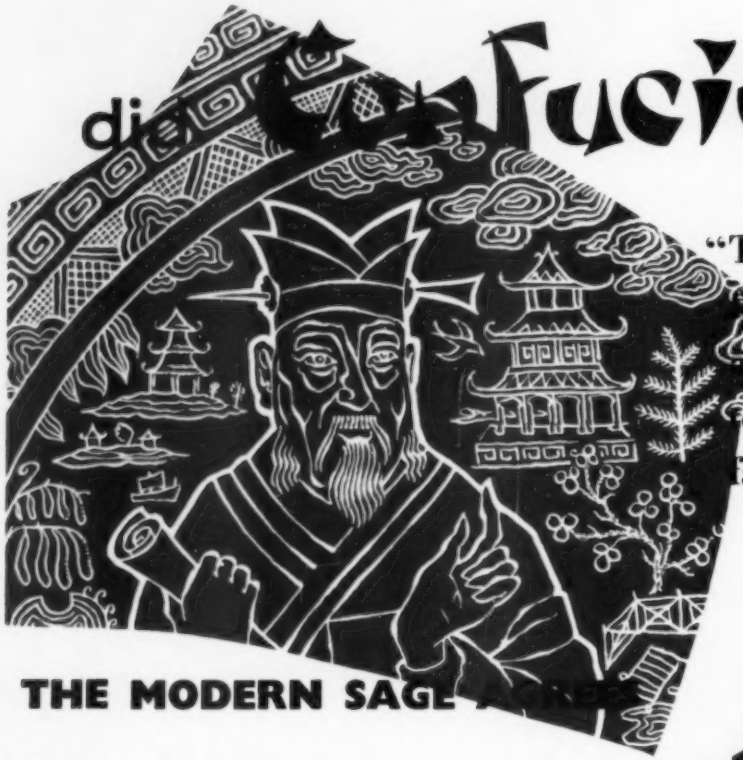


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Here's your first 'purpose-built' container design

Jacksons are really going ahead with that series of 'purpose-built' glass container designs (remember our last advertisement?).
Here's the first—a four-in-one segment stacking jar that could contain four different varieties of your product, or four entirely different products. The segments are separate, each with a snap-on cover and plenty of label room.
This is the kind of container the housewife will be able to use again and again. She'll look out for them in the shops; when she buys the products these jars contain, make sure the labels they are carrying are *yours*.
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A comprehensive service embracing design and advice on glass containers, closures, labelling, display boxes and outers. This service also offers to manufacturers, packing in containers other than glass, free market research facilities on 'design preference testing', 'container-in-use testing', and 'shelf testing', as well as an area test marketing service at a nominal charge.

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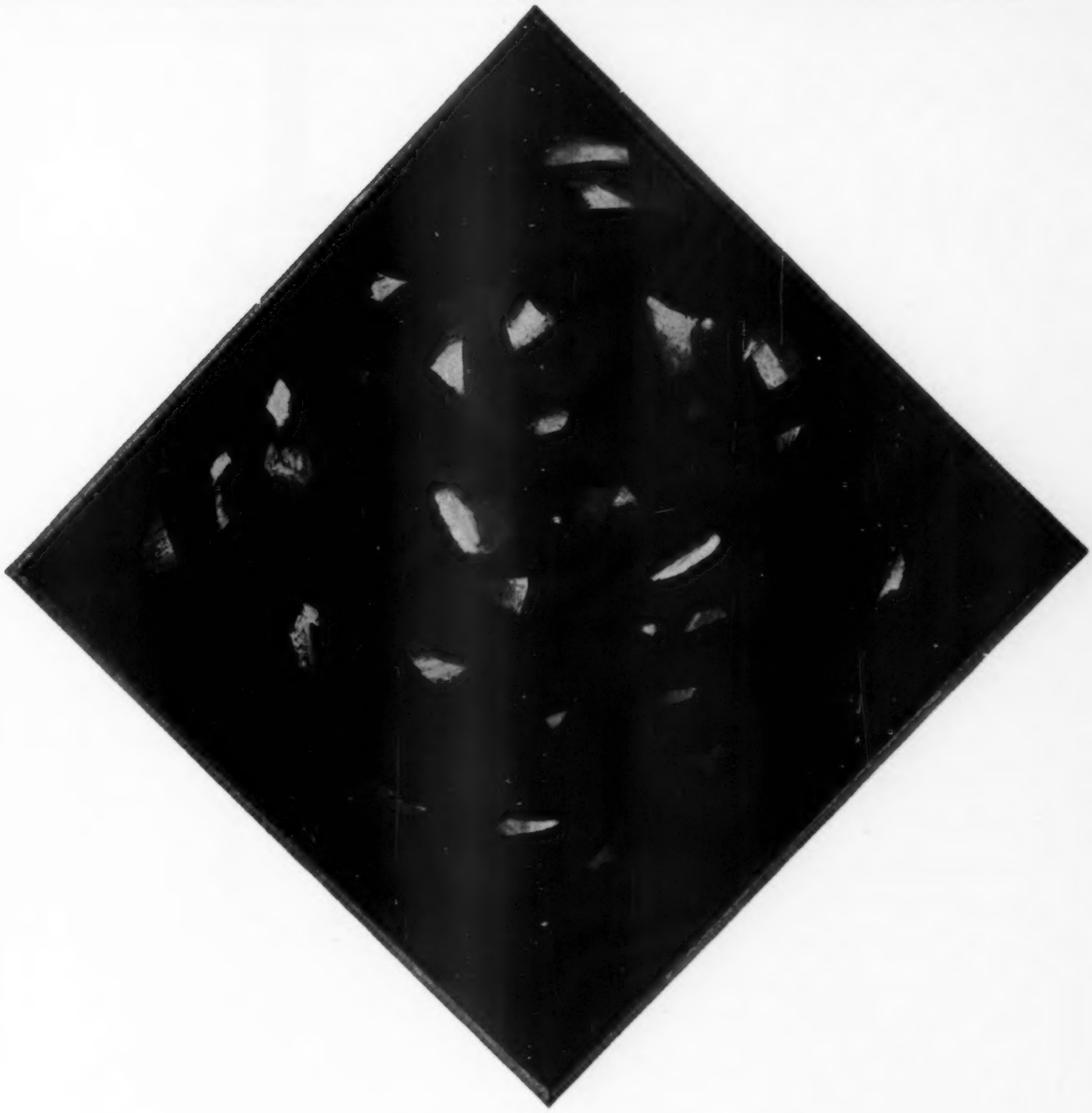


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Most paint and ink manufacturers get their bulk supplies of solvents from one of the six Methcol Depots—Hammersmith, Dagenham, Birmingham, Manchester, Hull and Glasgow.

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Denatured Methanol

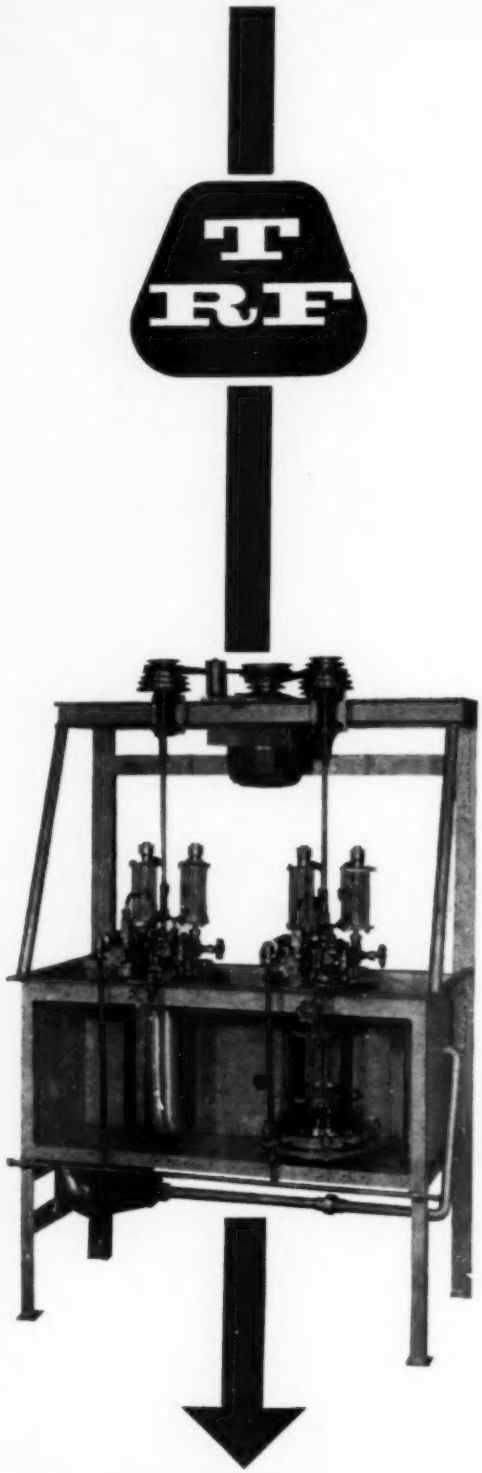
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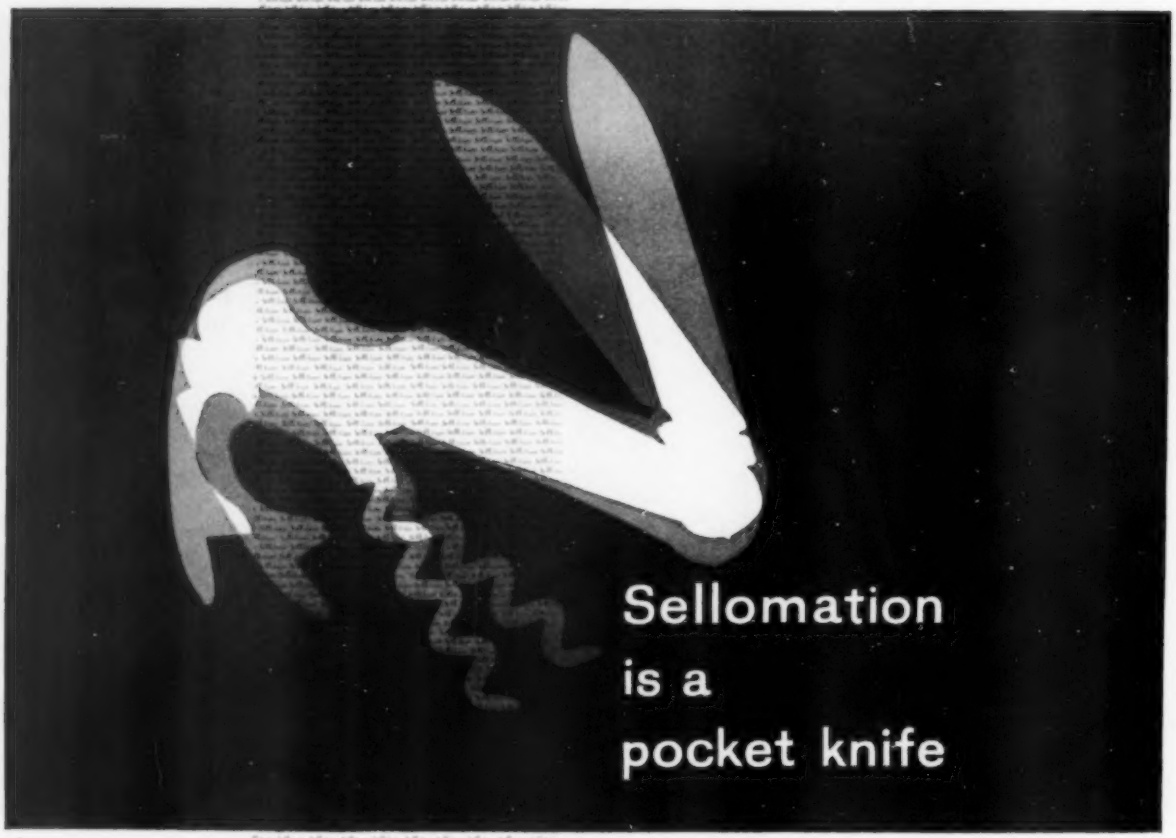
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Polythene Liners for the Chemical Industry

from Europe's largest maker of Polythene film

Now you can get polythene liners under the trade name 'Queensway', tailored for you by British Visqueen Ltd., the largest producer of polythene film in Europe.

What does this mean to you in the chemical industry?

Simply that the accumulated "know how", and the up-to-date equipment of British Visqueen are now geared to provide you with a comprehensive service for the design and supply of liners for all types of chemical containers.



EXPERT PACKAGING SERVICE British Visqueen have been the acknowledged experts on polythene film packaging for many years: they are the people who solve problems for packaging experts. They ensure the selection of the correct grade of polythene film, to be tailor-made into the ideal 'Queensway' liners for your products.



PROMPT DELIVERY Because of British Visqueen's modern equipment and large productive capacity, you can be sure of getting the right liners right on time, when you order 'Queensway' liners.



RELIABLE PROTECTION PLUS EFFECTIVE SEALING 'Queensway' liners offer you a thoroughly reliable means of sealing off pastes and hygroscopic powders of all types from their outer containers and protecting them in transit and during storage. Being made from British Visqueen's polythene film, they are resistant to most highly corrosive substances, completely moisture proof, chemically inert, extremely tough and easily sealed.

For a complete liner design and supply service that will pay you dividends in quicker handling and improved protection for your products, use 'Queensway' liners.

BRITISH VISQUEEN LIMITED

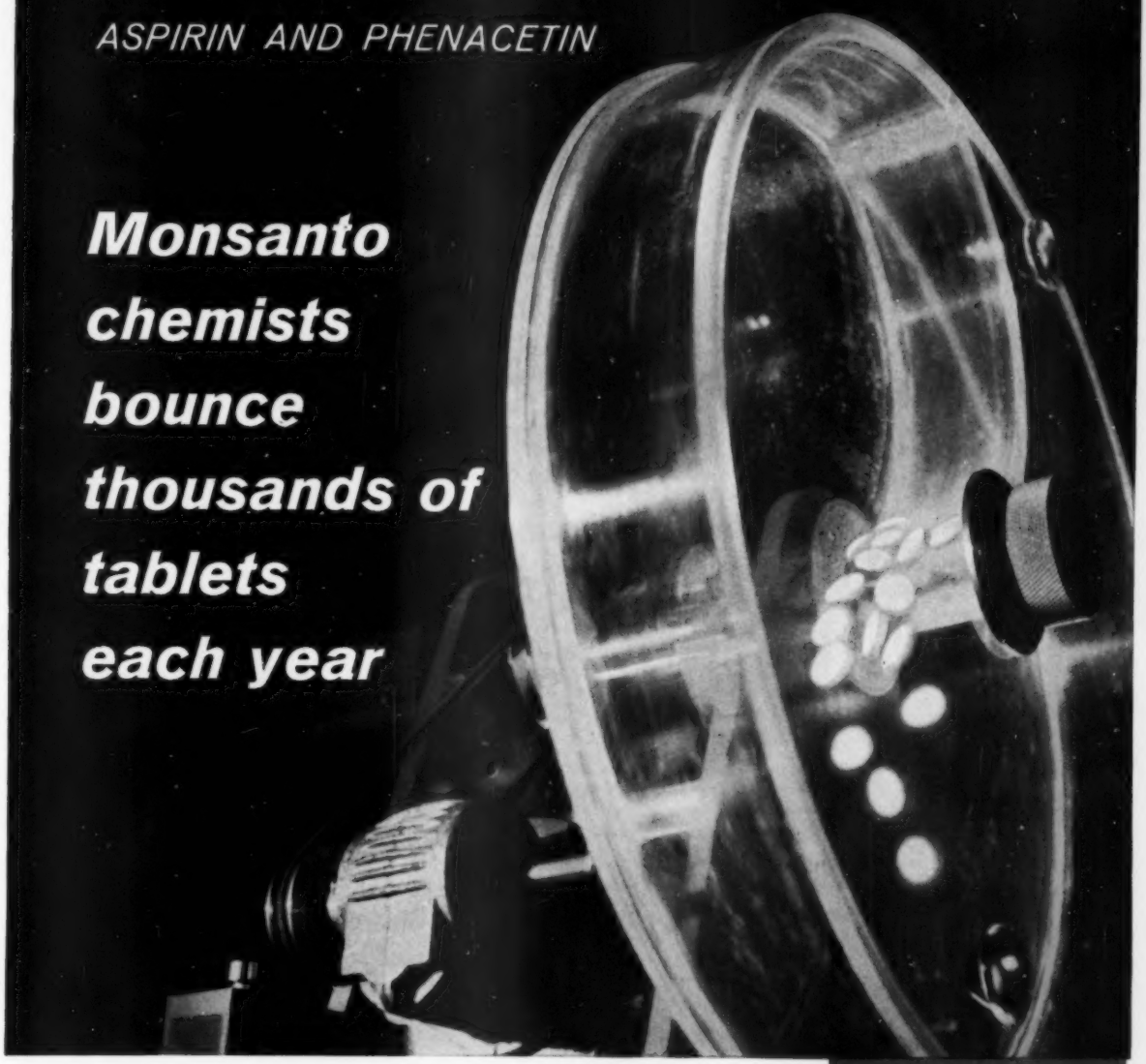
A SUBSIDIARY COMPANY OF IMPERIAL CHEMICAL INDUSTRIES LIMITED

QW 169

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ASPIRIN AND PHENACETIN

Monsanto chemists bounce thousands of tablets each year



Many problems met in the manufacture of tablets containing aspirin and phenacetin are being ironed out with the help of a series of tests developed by Monsanto chemists.

The above test reveals proneness to chipping. It helps Monsanto customers produce tablets that reach the consumer as perfect as the day they were made.

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The tests are part of a technical service provided for all buyers of Monsanto aspirin and phenacetin. A service that helps selection of the correct grade . . . that solves formulation problems . . . that offers sound advice on the manufacture of soluble aspirin tablets.

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THE NEW

R.A. series

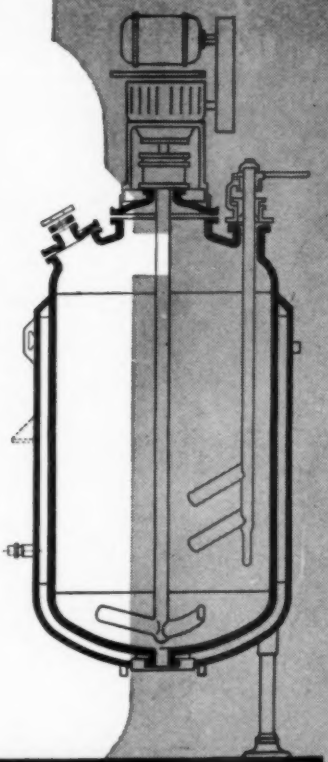
HIGH PRESSURE REACTION KETTLES —UP TO 3,000 GALLONS CAPACITY

Pfaudler's latest development in Glassed-steel

All-welded construction permits an internal pressure of 100 p.s.i. and a jacket pressure of 90 p.s.i. (75 p.s.i. if internal vacuum). A large main cover joint is eliminated and enables the RA Series to be used for catalytic and bacteriological processes where a submerged gasket would cause contamination. Full range of agitation can be provided by an agitator assembled through a top opening. All joints are fluon sheathed. The glass is highly resistant to acids and alkaline solutions up to a pH of 12 at 212°F.

RA Series reactors are built in a standard range of capacities from 200 to 3,000 gallons, but larger capacities and higher pressure units are planned for future production.

For full details please write for Bulletin RA.71. Pfaudler Glassed-steel equipment.



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Artillery House, Artillery Row, London, S.W.1. Telephone: ABBey 2168.

Leven, Fife, Scotland. Telephone: Leven 79.

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Glassed-steel storage and process vessels, transport tanks for Milk, Food, Brewing and Chemical Industries.

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OUR LINE FOR THE PHARMACEUTICAL INDUSTRY INCLUDES ALSO:

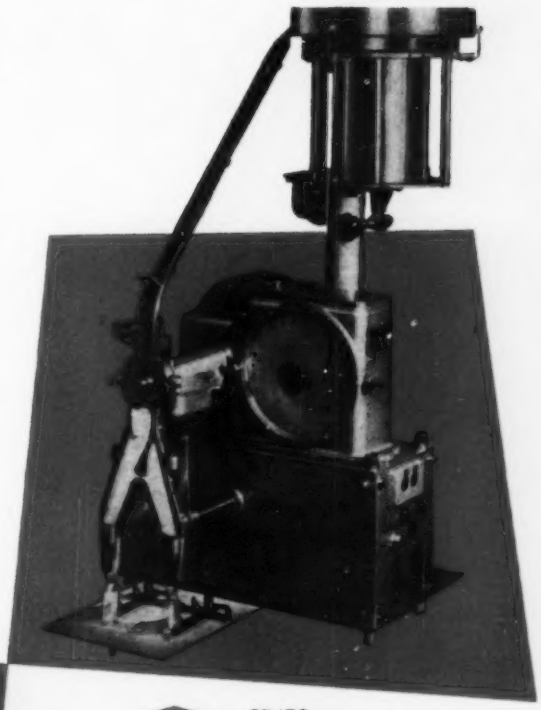
SA/59 Semi-automatic machine for filling capsules. Output: 1,500/hr.

LZ/57 Automatic machine for filling capsules. Output: 3,600/hr.

DL/sa/58 Semi-automatic machine for sealing capsules. Output: 3,000/hr.

DL/59 Automatic machine for sealing capsules. Output: 7/9,000/hr.

RV/59 Automatic machine for filling and sealing capsules. Output: 12/14,000/hr.





CR/58
Automatic machine for counting capsules.

See the range of Zanasi Machines at the ACHEMA Exhibition Frankfurt, June 9-17 H.S. Stand F.7.

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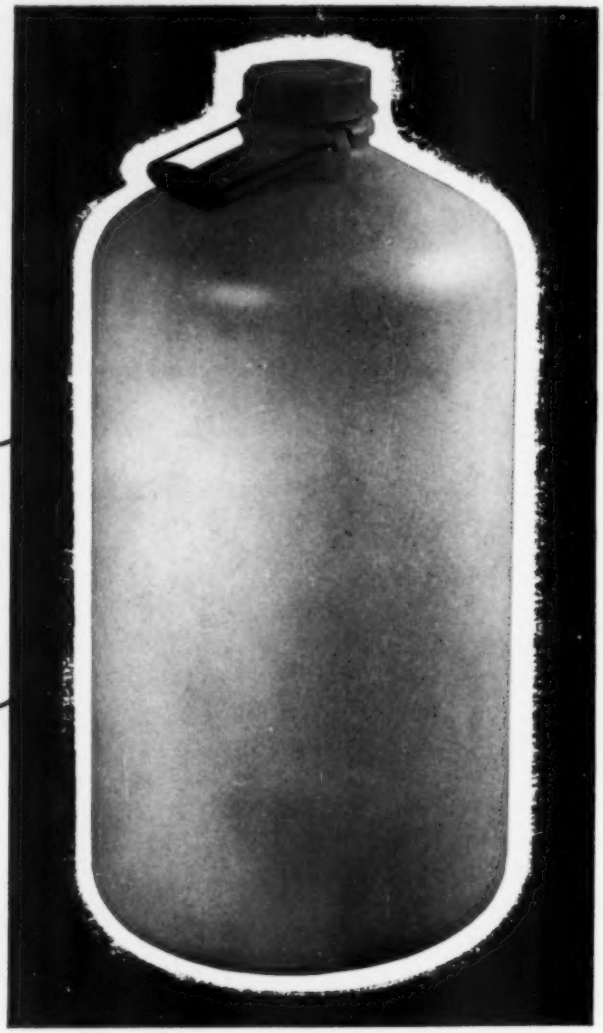
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5 gallon

BLOWN High Density

Polythene Container

INTERESTED IN OUR FULL RANGE ?

You are bound to find what you require from 5 c.c. to 5 Gallons in the FREEFLEX range, every one of which can be delivered ex. stock. You will find that it pays to use FREEFLEX Standard Blown Polythene Containers.



Now . . . here is a 5 Gallon, High-Density, Blown Polythene Container designed to save you money in handling and freight costs. It is extremely rigid and will give lasting service. This 5 Gallon Container will live up to the high reputation which FREEFLEX has earned over a wide field of industry, and is especially designed for use with heavy chemicals. What is more to the point, these 5 Gallon Containers are ready NOW . . . we can give you . . .

DELIVERY FROM STOCK

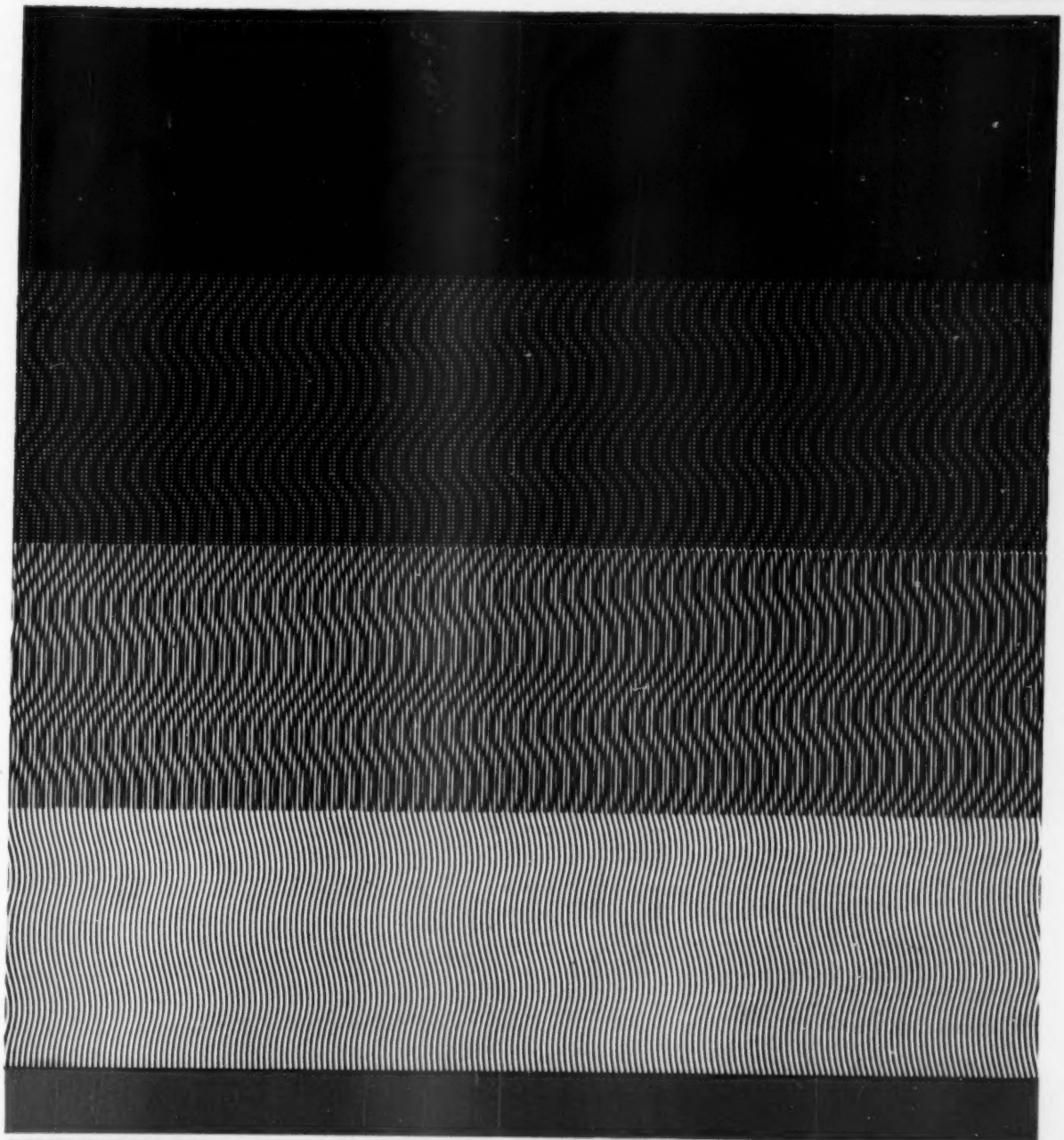
This FREEFLEX 5 Gallon Container is now standard in our range which covers capacities from 5 c.c. to 5 Gallons. You can confidently order now and be sure of delivery within a few days.

***IF YOU ARE INTESTED IN* CLOSURES**

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for extraction processes for oils, fats, waxes, pharmaceuticals and fine chemicals
for dry-cleaning, metal degreasing and formulating paint-removing compositions.

GC.14



Save £35 a week!

Pembroke's remarkable Foldmaster can set up any of twelve different types of carton, at a rate of up to 3000 an hour, *on your own premises*. Become a Pembroke customer, lease a Foldmaster and you save the wages of five or six girls *and* slash your handling costs.

Three more good reasons for talking packaging with Pembroke—

1 A brand-new factory with up-to-the-minute machinery, able to produce accurately and fast at competitive prices.

2 Executives fully experienced in design and production of cartons for automatic machine packaging (very much a speciality with Pembroke) and expert advice on design that sells from a fully-equipped studio.

3 A company big enough to take big orders, small enough to guarantee personal service from executives you know and trust.

Below are some of the companies who do business with Pembroke—these names speak for themselves.

ASSOCIATED ELECTRICAL INDUSTRIES LTD
THOMAS HEDLEY & CO. LIMITED
CROSSE & BLACKWELL LTD
STODDART & HANSFORD LTD
LESNEY PRODUCTS & CO. LTD
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For further information, write or 'phone:

The Pembroke Carton & Printing Company Ltd.

11 KINGSWAY LONDON WC2 TEL: TEMPLE BAR 6231

Special Purpose Chemicals

Uses Bulletin

For the preparation of shampoos for human and veterinary use, hand cleaning gels, germicidal skin cleansers — **EXONICS**, high foaming, low odour, mild surfactants compatible with most phenolic bactericides.

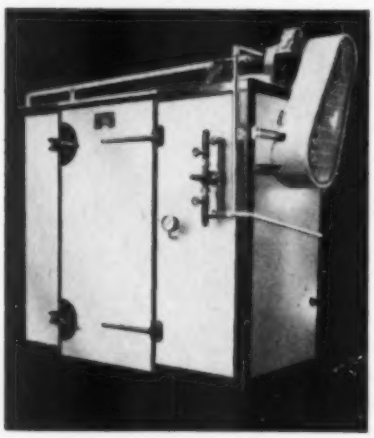
For the preparation of germicidal creams and ointments, hair conditioning creams and most cosmetic emulsions where cationic properties are desirable — **COLLONE QA** (Cationic Emulsifying Wax BPC).

For use in dairy sanitisers, antiseptic lotions, sterilising detergents, germicidal sprays, etc., —**MORPANS**, a wide and versatile range of quaternary ammonium compounds.

Glovers (Chemicals) Ltd., Wortley Low Mills, Leeds, 12 Telephone: 63-7247/8/9 Telegrams: "Glokem, Leeds"







A Briggs' single truck oven—one of the many steam, electrically and gas heated drying ovens in the Briggs' standard range.

Keeping dry and getting dried out are, of course, two entirely different things.

And we think it is worth pointing out right away that neither are even remotely similar to the science of controlled drying as it is understood—and understood very well—at Briggs'.

We have perfected a wide range of standard drying ovens which are sufficiently versatile to solve the difficulties of almost every manufacturer who has a drying problem. Standardisation, as all the best captains of industry will tell you, brings economy in its wake—and that means that Briggs' drying equipment is not only better, but cheaper.

At this point we have no wish to go all technical, as doubtless many readers are anxious to pass on to the other interesting advertisements in the paper; but before leaving us it is worth noting that we employ a very competent technical staff who are fully qualified to answer any queries you may have, and to advise on the best kind of drying equipment to install in those rare instances where specially designed ovens are required.

THE SPECIALISTS IN COMPLETE DRYING PLANT

BRIGGS OF BURTON

S · BRIGGS & CO · LTD · BURTON-ON-TRENT

Development Chemicals from Heavy Organic Chemicals Division

NUMBER TWO

	NAME	DESCRIPTION	QUANTITIES AVAILABLE
	Alcohol		
1	Tridecanol	Liquid. Boiling range 240-267°C. Mixture of isomeric branched-chain C_{13} primary alcohols. Uses similar to those of lauryl alcohol as intermediate for surface-active agents. Also intermediate for plasticisers, synthetic lubricants, and oil additives.	*8 oz samples. Tonnage quantities.*
	Antioxidant		
2	'Topanol' CA	Solid. Antioxidant for polymers especially polyolefins, e.g. polypropylene and polymers of ethylene.	*Samples in 8 oz bottles.*
	Organic Acids		
3	Nonanoic acid	Liquid. B.Pt. 231-268°C. Essentially 3,5,5-trimethyl hexanoic acid. Intermediate for metal salts for use as specialty paint driers, gelling agents, catalysts, and rot proofing agents.	*8 oz samples. Evaluation quantities up to 10 lb.*
4	C_7—C_{10} acid	Liquid. B.Pt. 238-358°C. Mixture of saturated branched-chain aliphatic monocarboxylic acids. Intermediate for metal salts for use as paint driers, gelling agents, catalysts, and rot proofing agents.	*8 oz samples. Evaluation quantities up to 20 lb.*
5	Isophthalic acid	Solid. M.Pt. about 340°C in sealed tube. Intermediate in the production of alkyd resins and high quality polyester resins. Potential plasticiser intermediate.	*Samples in 8 oz bottles. Enquiries welcome for cwt lots.*
6	Trimellitic anhydride (Product of Amoco Chemicals Corporation U.S.A., supplied by I.C.I. in the United Kingdom only)	Solid. M.Pt. about 168°C. Intermediate for oil-soluble and water-soluble alkyd resins. The trifunctional structure gives high reactivity for production of unsaturated polyesters, plasticisers, and epoxide resins.	*Samples in 8 oz bottles. Small evaluation quantities.*

■ featured for the first time

	NAME	DESCRIPTION	QUANTITIES AVAILABLE
	Phenols		
7	Cumylphenol (*p*-(α, α-dimethlybenzyl) phenol)	Solid. M.Pt. 72-73°C. Intermediate for special oil-soluble, 100% phenolic resins for surface coatings of outstanding flexibility, durability, and resistance to acids and alkalis.	*Samples in 8 oz bottles.*
8	2,5-Xylenol (technical)	Solid. M.Pt. 60-70° C. Contains 80-90% by weight 2,5-Xylenol. Intermediate for varnish resins, plasticisers, adhesive resins, weedkillers, and antiseptics.	*Samples in 8 oz bottles. Quantities up to 1 ton from stock; larger quantities by arrangement.*
	Butylated Phenols		
9	3-Methyl-4, 6-ditertiary butylphenol (3M46B)	Solid, M.Pt. 56-58°C (technical quality). Intermediate for products used in the rubber and plastics industries. Other specialised uses.	*Samples in 8 oz bottles. Tonnage quantities.*
10	3-Methyl-6-tertiary butylphenol (3M6B)	Solid, M.Pt. 21-22°C (refined quality). Rubber chemical. Intermediate for rubber chemicals and synthetic perfumes, e.g. musk ambrette.	*Samples in 8 oz bottles. Tonnage quantities.*
	Propylene Derivatives		
11	Propylene dichloride (1,2-dichloropropane)	Liquid. B.Pt. about 96°C. Solvent for fats, waxes, and organic products. Chemical intermediate.	*8 oz samples. Ton lots.*
12	Dichlorodiisopropyl ether	Liquid. B.Pt. about 187°C. Solvent for fats, waxes, and organic products. Chemical intermediate.	*8 oz samples. 45 gal drum lots.*
13	Dipropylene glycol	Liquid. B.Pt. about 232°C. Polyester resin intermediate. Solvent, humectant, component in hydraulic fluids, and plasticiser for cork and paper.	*8 oz samples. Evaluation quantities by arrangement.*

IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON S.W.1

Please send more information on these chemicals:

■ 1 ■ 2 ■ 3 ■ 4 5
6 7 8 9
10 11 12 13

NAME: .....

TITLE: .....

COMPANY: .....

ADDRESS: .....

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HDI

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Citric Acid, B.P.
Citric Acid Anhydrous
Sodium Citrate U.S.P.

GLUCONATES
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Calcium Gluconate, B.P.
Potassium Gluconate
Sodium Gluconate
Magnesium Gluconate
Manganese Gluconate
Copper Gluconate (Cupric)
Glucono-Delta-Lactone

LITHIUM SALTS
Lithium Benzoate
Lithium Carbonate
Lithium Chloride
Lithium Citrate
Lithium Salicylate

TARTRATES
Tararic Acid, B.P.
Cream of Tartar, B.P.
Sodium Potassium Tartrate, B.P. (1953)
Tartar Emetic, U.S.P.

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Calcium Cyclamate (Calcium Cyclohexyl Sulfamate)
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* Sorbistat-K (Potassium Sorbate)

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CH21/1720

CARTONS

- ✓ Cartons - can and bottle carriers
- ✓ Cartons - corner glued
- ✓ Cartons - double compartmented
- ✓ Cartons - dry waxed
- ✓ Cartons - folding and display
- ✓ Cartons - glassine lined
- ✓ Cartons - glue end
- ✓ Cartons - greaseproof coated
- ✓ Cartons - greaseproof lined
- ✓ Cartons - hi-gloss
- ✓ Cartons - highly protective
- ✓ Cartons - locked corner
- ✓ Cartons - lock end
- ✓ Cartons - novelty
- ✓ Cartons - polythene lined
- ✓ Cartons - precision for high speed filling
- ✓ Cartons - quick assembly
- ✓ Cartons - snap-set base
- ✓ Cartons - tuck in end
- ✓ Cartons - two piece
- ✓ Cartons - window

CARTONING SYSTEMS: MECHANISED

- ✓ Diotite
- ✓ Kliklok
- ✓ Sellex
- ✓ Expresso
- ✓ Embelux

MULTIPLE PACKAGING SYSTEMS

- ✓ Jak-et-Pak
- ✓ Splitpak — new!
- ✓ Carrycan
- ✓ Can Trak

OUTERS

- ✓ Outers - corner glued
- ✓ Outers - crash bottom
- ✓ Outers - display
- ✓ Outers - wire stitched

TRAYS

- ✓ Trays - corner glued
- ✓ Trays - corner locked
- ✓ Trays - corner stitched

M|B METAL BOX
PAPER GROUP
makes the lot!

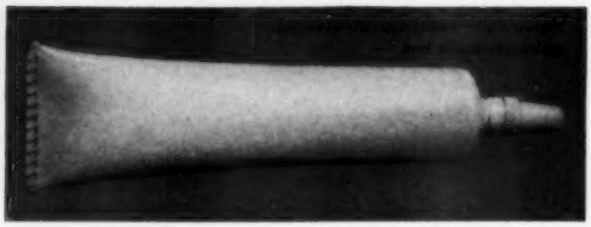
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Armoured bottles that need no outer packing—5 gal. & 10 gal.

UNBREAKABLE Cascelloid CONTAINERS





POLYTHENE TUBES

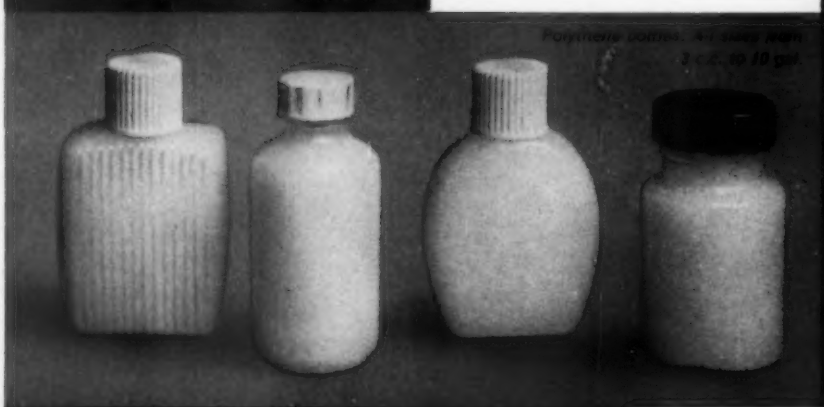
BOTTLES

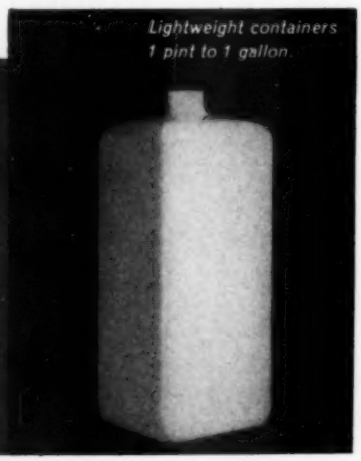
BULK CONTAINERS

BAGS

ARMOURED BOTTLES

Cascelloid ranges of polythene tubes, bottles, packs and other specialised containers may well provide the perfect solution to your packaging problems. Wealth of experience and scale of production enable Cascelloid containers—lightweight and virtually indestructible—to be offered in great variety at realistic prices. They are suitable for almost any type of contents.





Lightweight containers 1 pint to 1 gallon.



Polythene film bags—translucent and tough.

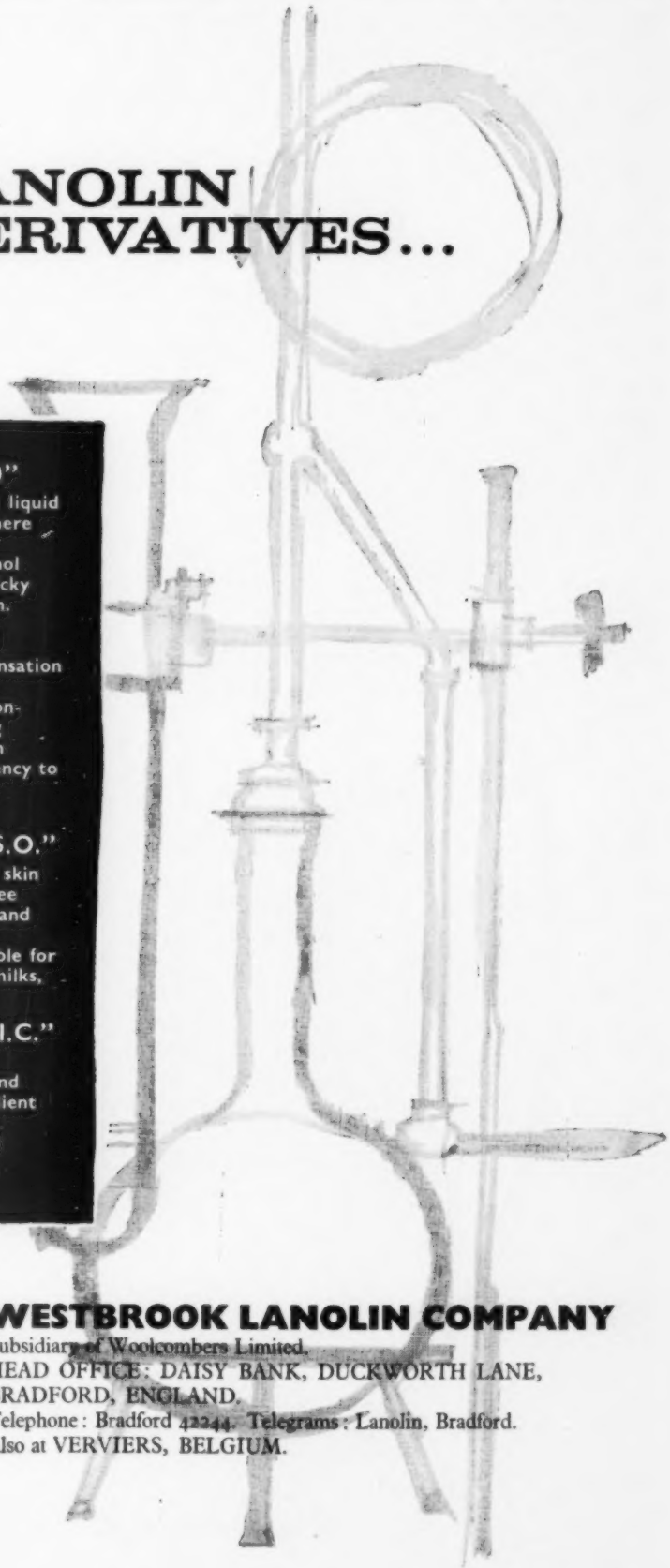
Samples, suitability checks, prices, advice from:

Cascelloid

ABBEY LANE, LEICESTER (Division of the British Xylonite Co Ltd) Tel: 61811

London Office & Showrooms: 27 Blandford St, W1 Tel: WELbeck 9211

LANOLIN DERIVATIVES...



LIQUID LANOLIN "60"

This pure anhydrous Lanolin, in liquid form, is particularly suitable where a low viscosity is desirable. Completely soluble in isopropanol and higher alcohols. It is non-sticky and readily absorbed by the skin.

WATER SOLUBLE LANOLIN

A Lanolin/ethylene oxide condensation product. Available in different grades, pale in colour, stable, non-ionic, with oil/water emulsifying characteristics. Solutions vary in clarity from complete transparency to slight turbidity depending upon the concentration.

LIQUID LANOLIN "I.S.O."

Possesses outstanding powers of skin penetration and is completely free from residual stickiness. Clarity and fluidity are retained at low temperatures. Particularly suitable for use in skin lotions, complexion milks, brilliantines, hair sprays etc.

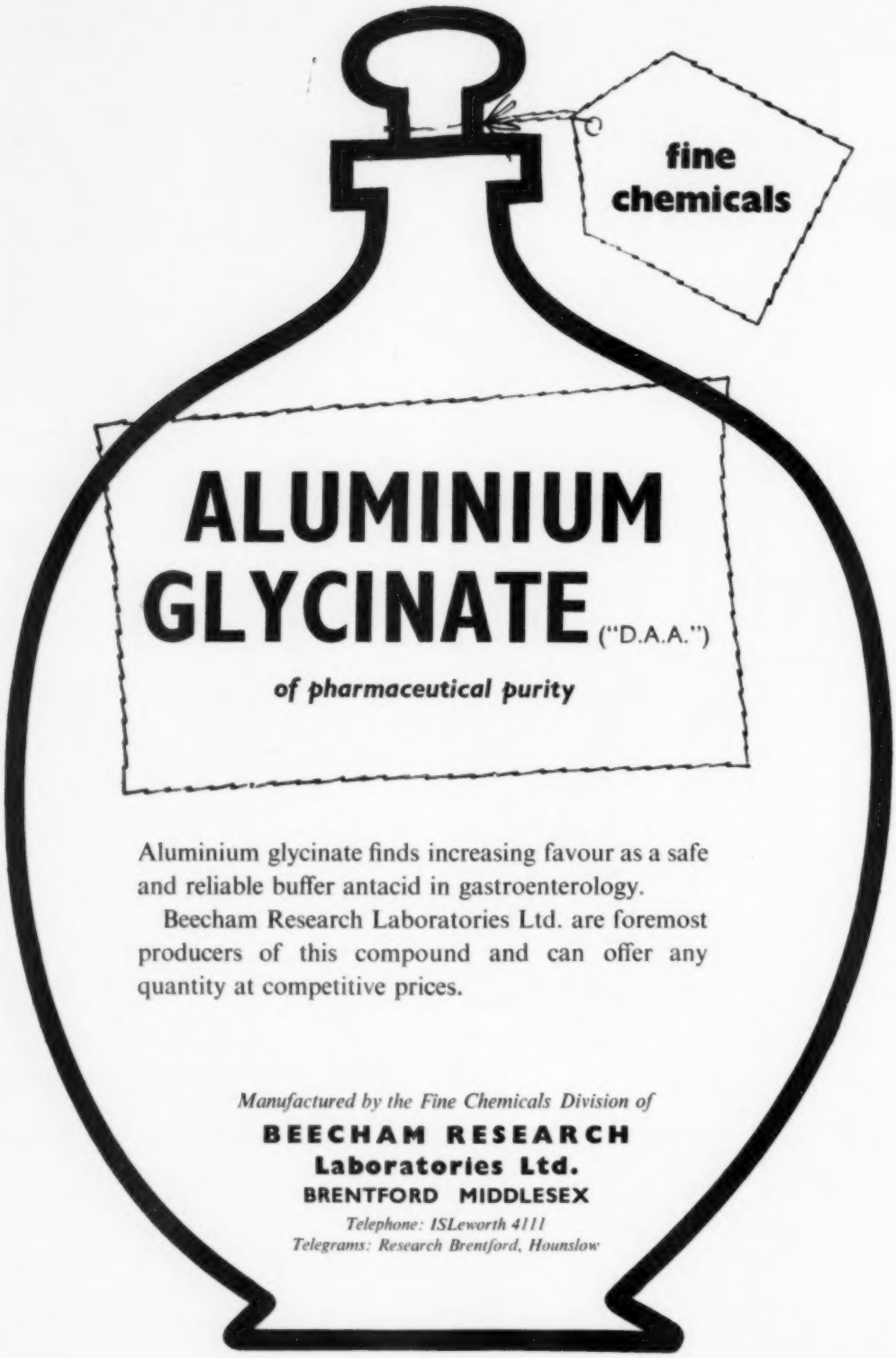
LIQUID LANOLIN "R.I.C."

This product is an excellent conditioning agent for the hair and a combined solubiliser and emollient in lipsticks. Good solubility in isopropanol, acetone and aerosol propellants.

GOLDEN DAWN LANOLIN

WESTBROOK LANOLIN COMPANY

Subsidiary of Woolcombers Limited.
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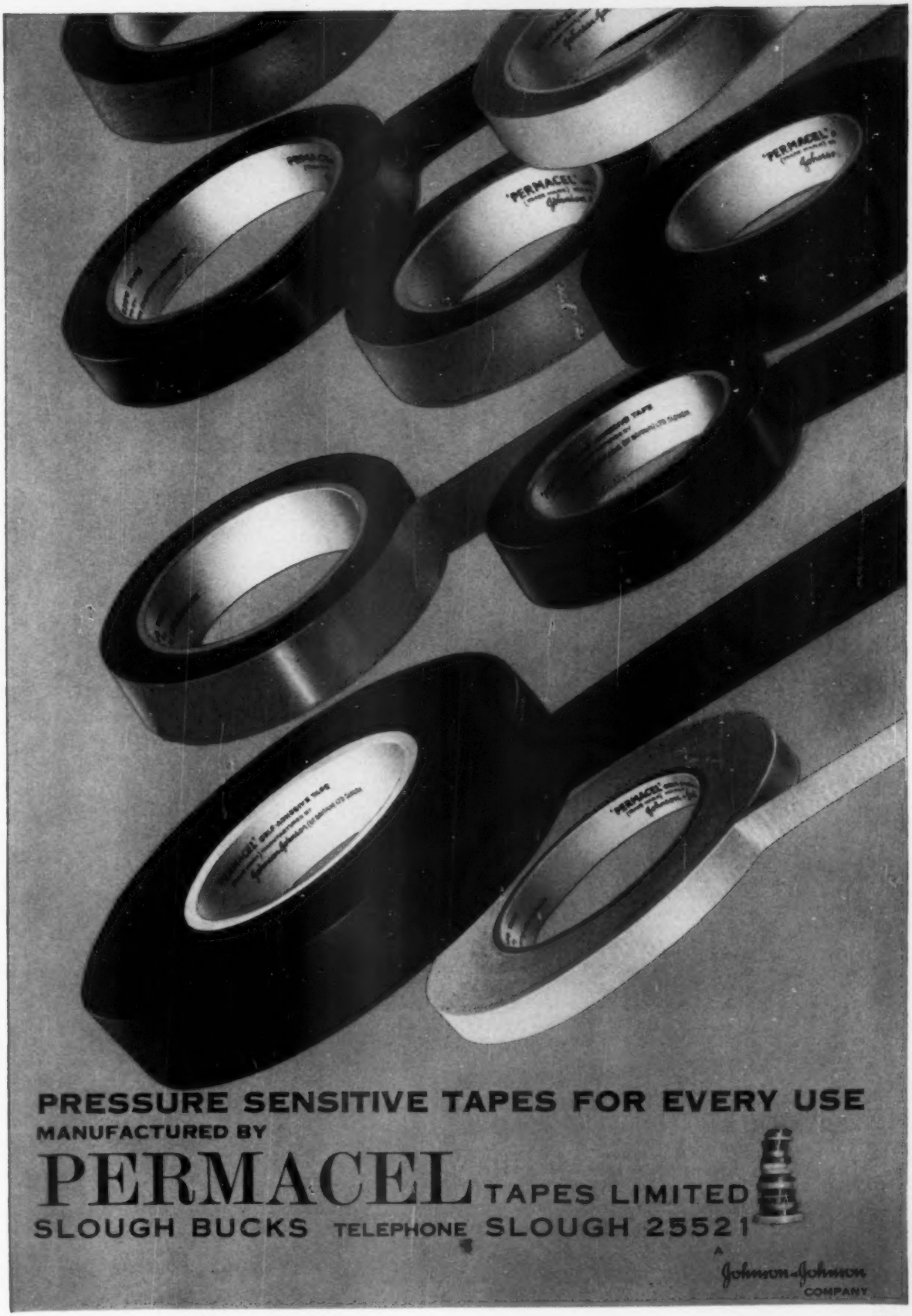
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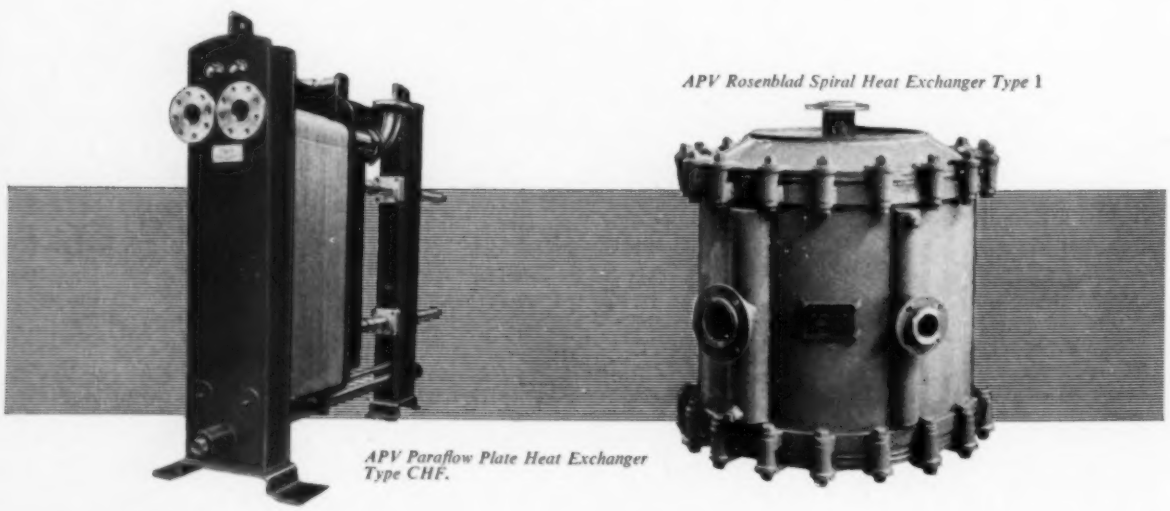
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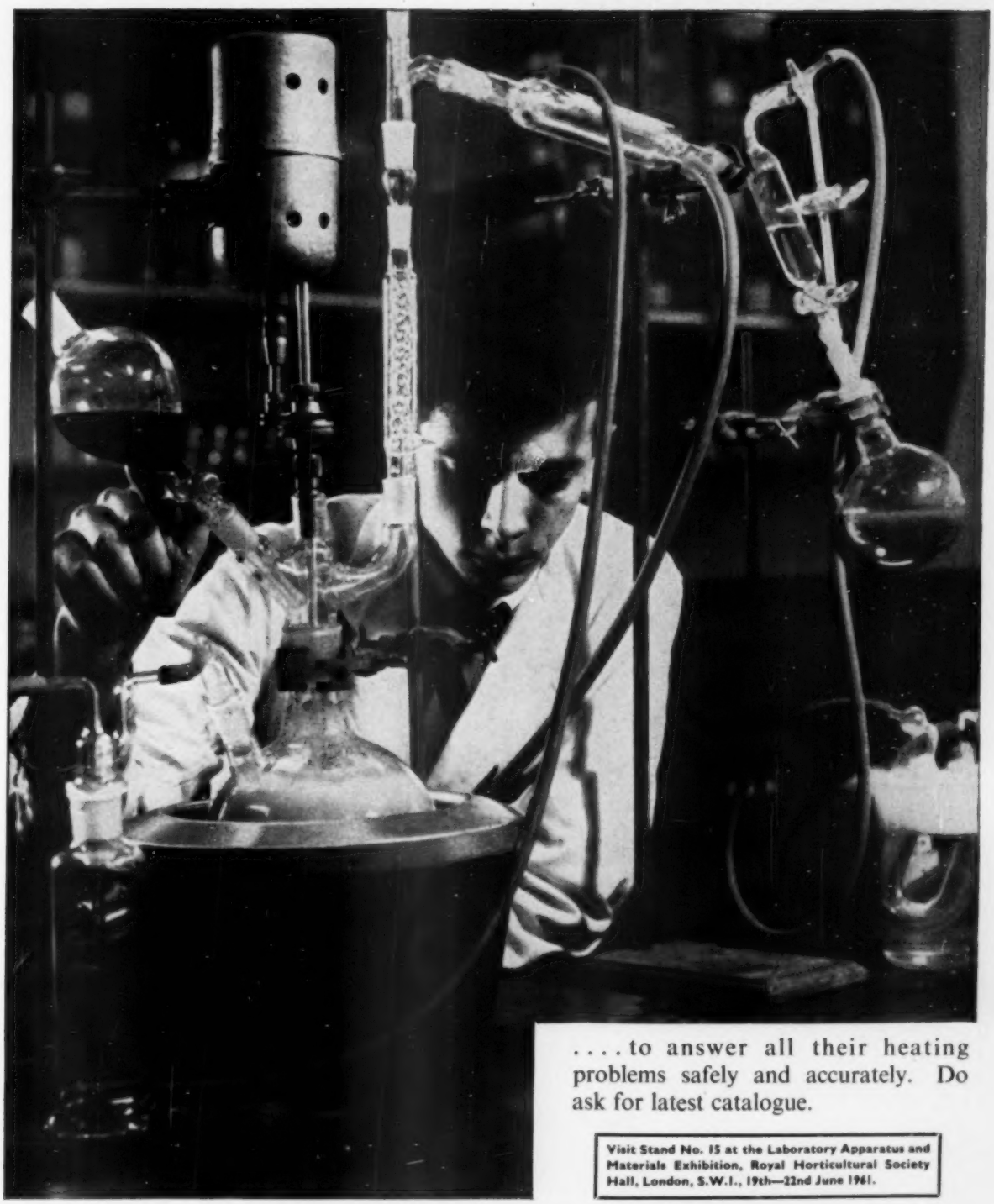
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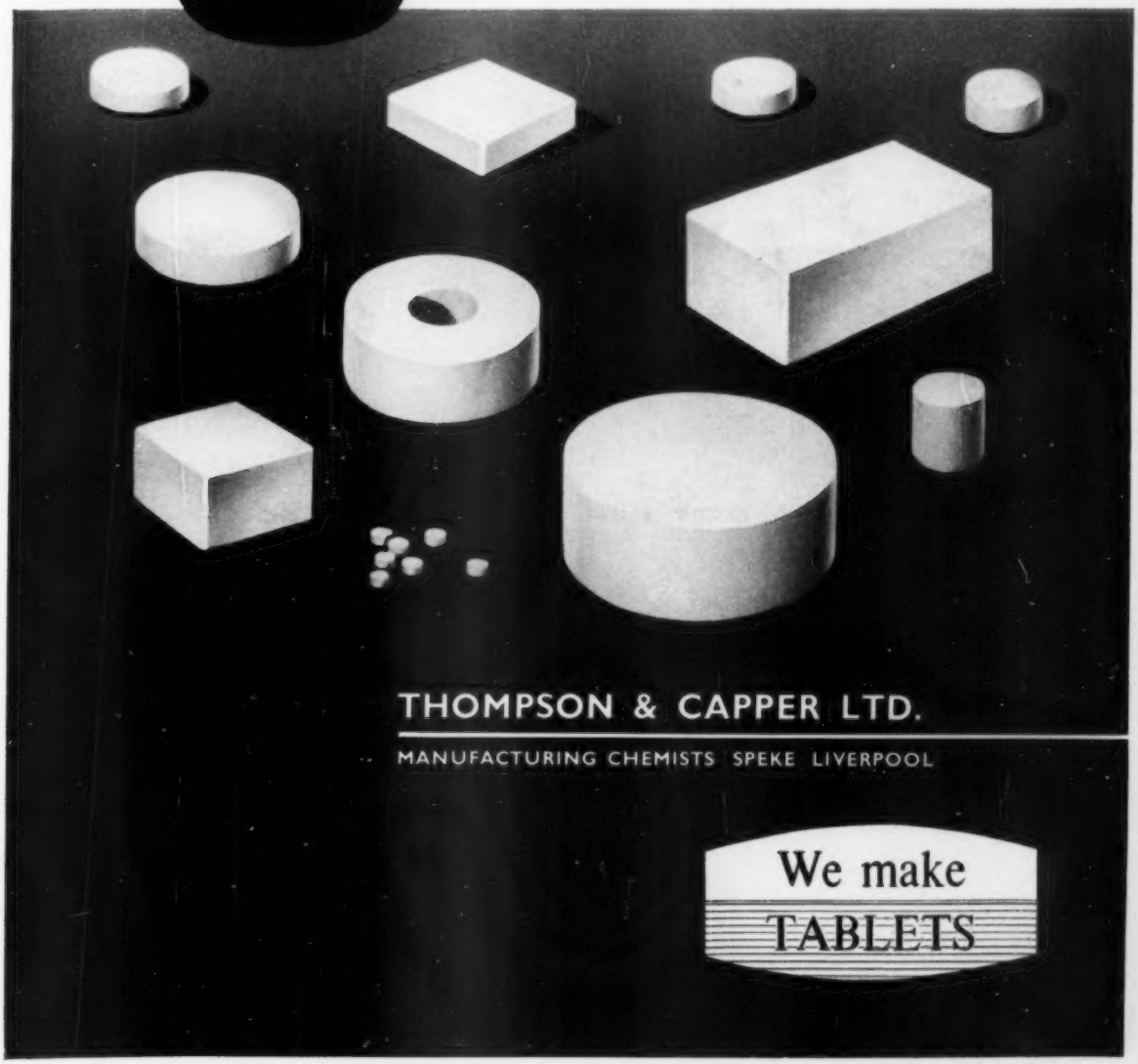
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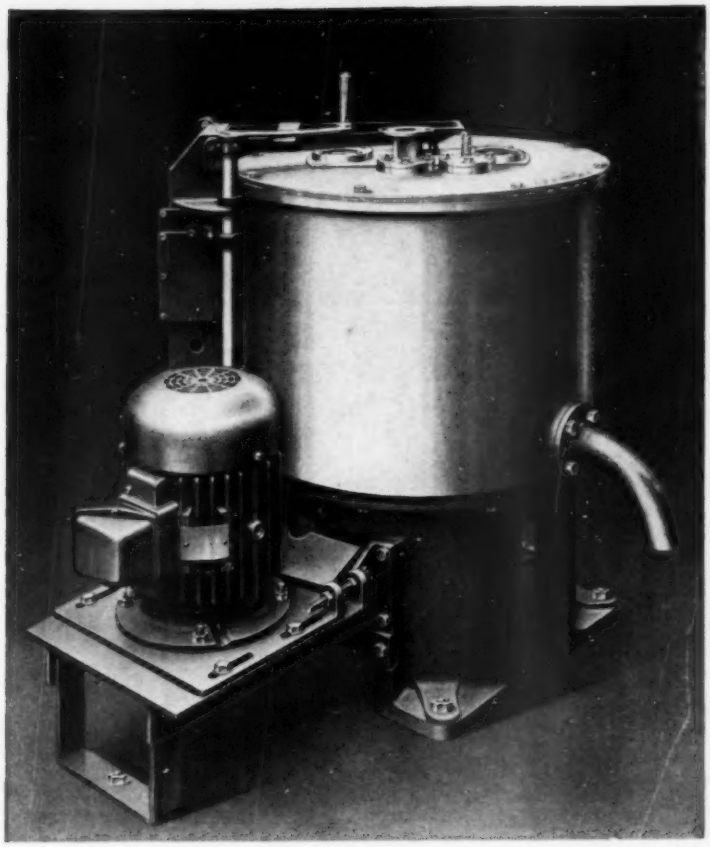
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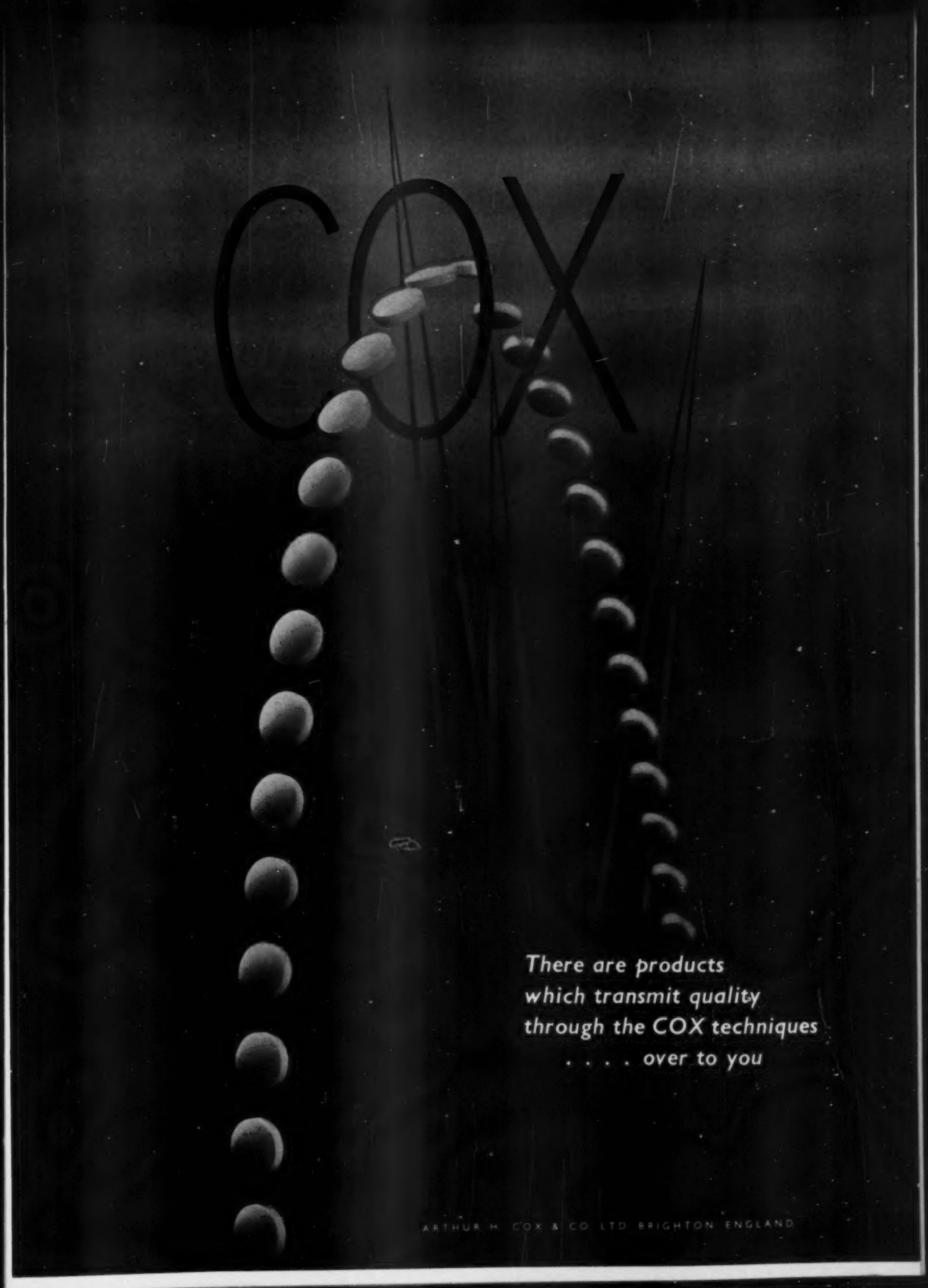
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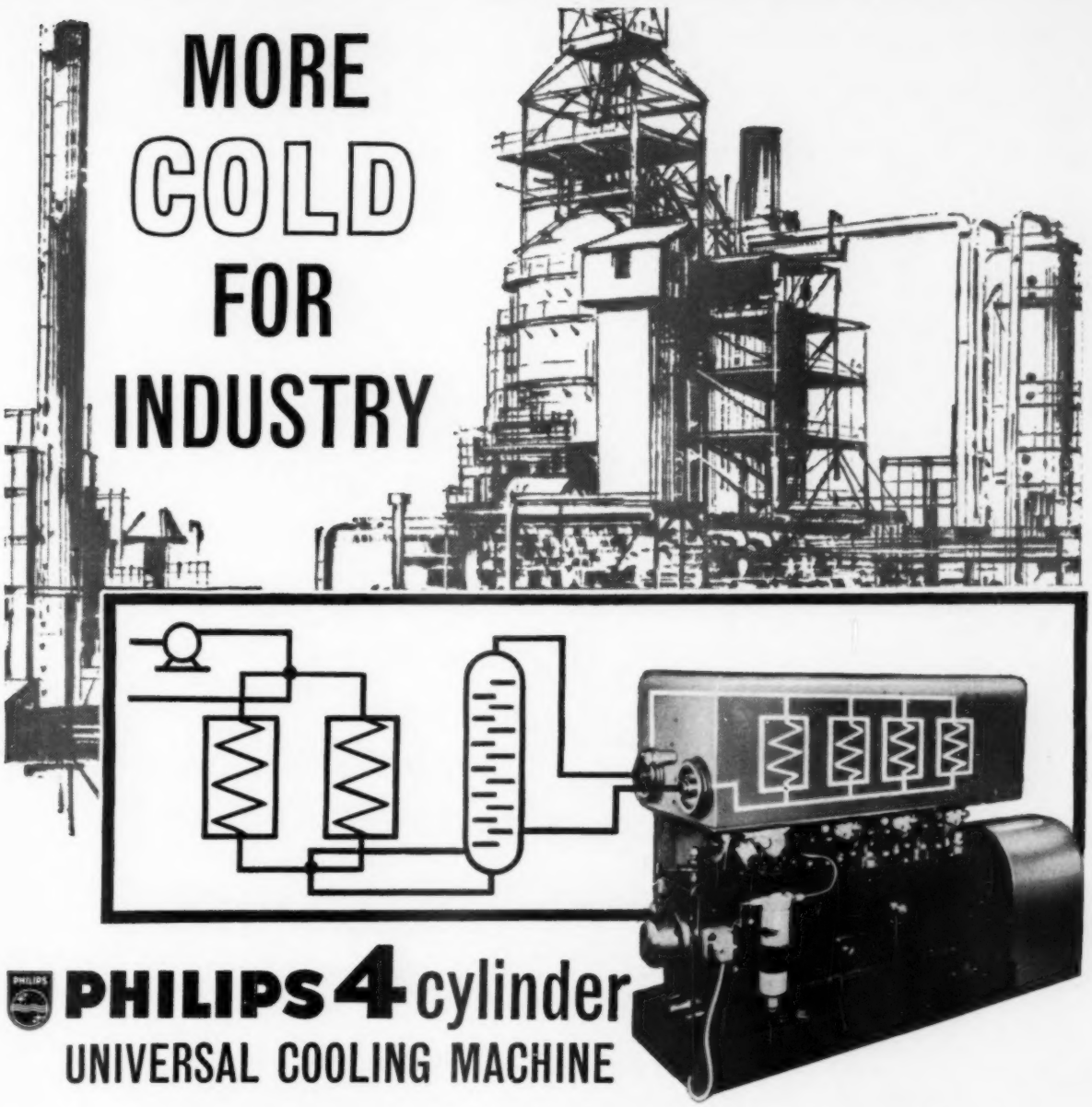
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Editor: W. G. Norris

Vol. XXXII, No. 6 JUNE, 1961

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Topics and Comments

Nationalisation—first step?

AFTER his fair and friendly words at the Association of British Pharmaceutical Industry dinner in April, Mr. Enoch Powell's raid upon pharmaceutical patents is all the more surprising and shocking. "I am neither the lackey nor the scourge of the industry," said Mr. Powell. He is certainly not the lackey, but now we are not so sure about the other epithet. The new scheme for buying drugs from unlicensed suppliers (see our news pages) arms him with a whip to tickle or lash the industry as and when he wishes.

The manufacture of patented drugs by pirates in countries where there is no patent protection, or process but not product patent protection, has long worried the industry. In Britain, until now at least, there has been protection against this unfair competition which makes it so beautifully easy to make cut price drugs. Now, by invoking the formidable section 46 of the Patents Act, the Minister opens the British market to the pirates. Certainly he does not propose to avoid royalty payments altogether. But he, not the patentee, will decide on the payment. The right of a patentee to fix the level of royalty payment to enable him to recoup his costs and put aside something for further research is thrown aside. The green light has been given to the pirates and the red warning is flashing for patentees. Why should a firm invest money in drug research if it will henceforth be deprived of the right to get a proper return for its investment?

This is not the place to dilate upon the hazards of drug research. Everyone knows about the successes, few know or care about the thousands of failures which are just as costly and which by every test of reasonableness should be recouped from the profits of the successes. The Minister has taken this bitterly controversial action because he is obviously not satisfied that the prices charged for the three drugs to which the scheme will first apply (tetracyclines, chloramphenicol and chlorothiazide) are "fair and reasonable." How do manufacturers satisfy this fearfully arbitrary criterion? Obviously they are asked to submit to an inquisition quite foreign to accepted ideas of private enterprise industry—ideas which, be it noted, are the mainstay of the Conservative faith to which the Minister subscribes. Since the industry has increased its exports year by year and now sells over £40 million worth abroad it would seem that its prices are fair and competitive. Has the Minister considered the bad effects of his action upon exports?

The Association of British Pharmaceutical Industry now has the bitter and unending task of fighting for the rights of patentees. Having breached the bastion of pharmaceutical invention the Minister will certainly not rest content, and other patented drugs will no doubt soon be given the same treatment.

It has fallen to a Conservative minister to forge a weapon that virtually nationalises the patents of the drug industry. When a Labour government comes to power the next step will be irresistible—outright nationalisation of the industry. No industry is less likely to flourish under such shackles.

An answer to wound inflammation?

AT THE National Institute for Medical Research, attempts are being made to find an agent that will counteract the inflammation that occurs in wounds. The key to this research is bradykinin, a substance that is formed in blood and which is the most active blood vessel dilator known—a millionth of a gram is effective. It is possible that a variant of the bradykinin structure will block its action.

The chemistry and constitution of bradykinin was described in MANUFACTURING CHEMIST in April (p. 173). At the Royal Society Conversazione in London last month the N.I.M.R. workers threw more light on this potent substance. When a tissue or organ becomes active—for example, when a gland starts secreting—an extra supply of nourishment is required. This nourishment is normally carried to the tissue by the blood stream. In order to provide the extra supplies needed during activity an increased flow of blood is required. It has been shown that bradykinin is formed in certain tissues during activation in order to dilate the blood vessels, thereby bringing about the required increase in the flow of blood to the tissue. Bradykinin has recently been obtained in pure form from blood and its chemical constitution has been determined. It is composed of simple units—amino acids—and there are five different amino acids joined head to tail in a definite sequence of nine.

When the mechanism by which bradykinin is formed in the body is upset, for instance when a tissue is damaged, large amounts of bradykinin accumulate and in these higher concentrations bradykinin not only dilates blood vessels but exerts other effects, which lead to inflammation.

Tablet identification

A VERY strong case can be made for instituting an infallible and universal scheme for marking tablets. It would assist in the treatment of poisoning by otherwise unidentifiable tablets and it would assist in the prescribing of further supplies of tablets already in the patient's possession, or in prescribing continuation treatment with other medicaments. A number of manufacturers already mark their tablets, but in general these are uncoated or compression



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coated. Marking pan coated tablets would be much more difficult. However, these markings would not fit in with a universal scheme which would have to be based on code letters and numbers.

The joint committee of the British Medical Association and the Pharmaceutical Society has been considering the feasibility of universal tablet identification. Technically it is possible but economically it is not. Production costs would be increased in several ways. Separate punches would have to be bought for each tablet. This would in itself be costly, would lead to small runs and still smaller runs for tablets destined for export because, of course, it is unlikely that a British identification code would be acceptable abroad. Stocks would have to be duplicated and handling costs would increase.

Then there would have to be a central bureau to allocate marks, keep the code list up to date and distribute it to doctors and pharmacists. It is obvious that the apparatus of control would be so costly, apart from the extra costs imposed on manufacturers, that a heavy extra burden would be placed on the National Health Service. The B.M.A.-P.S. committee thinks it would cost several million pounds a year and take five years to implement. In the face of these estimates it seems that universal tablet identification is something we cannot afford.

Those washing powder "bargains"

THE fictitious price cutting that soap and detergent makers have indulged in is to stop at last. Instead of the "3d. off" offers the price is to be cut by 3d., with *pro rata* reductions for smaller packs. Price cutting will always stimulate sales for a little while, but the advantage disappears completely when everyone cuts prices and the original offer is seen to be not a genuine bargain but simply a gimmick. Yet only a year or two back the then chairman of Unilever solemnly defended the "3d. off" schemes. Now, both Unilever and Hedley, the leaders in the market, have reduced prices. Hedley's frankly admit that cut price offers are now useless. Unilever say they can now cut prices because of increased efficiency. Let us hope that the fictitious price cutting which has spread to toothpaste and toilet soap will also cease. At best these offers are doubtful expedients. To continue them is to insult the intelligence of the public.

It seems that the whole advertising policy for washing powders is being overhauled. Comparisons with "brand X" in T.V. advertisements are to cease at the request of the Independent Television Authority. The millions of pounds worth of free publicity for "brand X" is now being exploited by a bright fellow who is marketing a "cleans everything" powder called . . . Brand X.

Would the sales of soaps and detergents really suffer badly if a little less money were spent on advertising? A sophisticated market such as we have in Britain would surely respond better to improved products and lower prices. It might be worth trying.

Radio pills

THE latest pills are radio-pills, not radioactive but real radio transmitters. By an almost incredible feat of miniaturisation radio sets about $\frac{3}{8}$ in. in diameter and less than 1 in. long have been made and fitted with the devices necessary to measure pressure, temperature and *p*H. The pills are swallowed and during their few hours' journey through the gastro-intestinal tract they transmit information about that *terra incognita* of the human body that was formerly only imperfectly obtainable by inserting tubes or wires into the mouth or rectum.

The new technique is micro-telemetry. It enables physiological variables to be measured without the slightest discomfort to the patient, or indeed to the healthy person, for the technique is being used to explore the physiology of good health as well as disease.

The pressure and temperature pills each contain eight components. The *p*H pill contains 11 components, including a glass electrode. The pills are powered by tiny batteries. A small loop aerial connected to a special radio receiver picks up the signal from the radio pill and allows transmitted data to be recorded. Pressure-sensitive pills have been used in clinical research for some time.

The pills were demonstrated at the recent Royal Society Conversazione in London by scientists from the Central Middlesex Hospital and the National Institute for Medical Research. They are being made by two British companies, Solartron and Electronic Instruments. As production increases it is hoped to reduce the price to about 40s. to 50s. a pill, approximately half the present price. Although in some experiments the pills have been recovered and re-used the intention is that they should in fact be used only once, and if the price can be reduced to one comparable with the cost of a normal X-ray this will be economically feasible.

Already industrial uses for the pills are being investigated. For example, they could be used to measure the exact temperature of the cooking process occurring in the centre of a can of baked beans or the temperature inside a block of ice-cream during manufacture. Unilever are reported to be interested in industrial uses for these extraordinary pills.

Torrent of inventions

THE Patents Office continues to be one of the busiest departments of the Government. Last year the numbers of applications for patents and of complete specifications filed were the highest ever received by the Office. No fewer than 44,914 applications were received (compared with 44,495 in 1959 and 30,513 in 1951) and 35,412 complete specifications were filed (compared with 33,653 and 22,694).

Fortunately the Patent Office is at last attracting the additional staff it needs to cope with the torrent of inventions that engulfs it year after year. Thirty-five new examiners joined in 1960 and after allowing

for retirements there was a net gain of a dozen. More examiners are still needed. The improvement in the staff led to the first reduction in eight years in the number of unexamined complete specifications. By the end of 1960 the arrear had fallen from 37,068 to 36,695 despite an intake of 35,412 specifications—nearly 2,000 more than in 1959.

The trend of chemical invention in 1960 continued towards organo-metallic compounds, especially organo-aluminium compounds used as catalysts for polymerisation and anti-knock agents for fuels; some of these agents were found to have therapeutic properties. The chief activity in synthetic drugs was among those which relieve pain, act as sedatives or tranquillisers, lower blood pressure, or reduce the amount of cholesterol in blood. The fashionable projects in therapeutics continue to be fashionable.

In chemical engineering it is interesting that a new development is the use of concrete for pressure vessels for nuclear reactors. In textiles there was increasing activity in the treatment of yarn to enhance its bulk and stretch properties. Interest was shown in the coating of pre-stretched transparent films which can be shrunk around frozen foods. Cigarettes, perennial subjects of invention, continue to inspire new ideas; most of last year's inventions concerned filter tips.

Status seekers

THE Institution of Chemical Engineers is a swiftly-growing professional body. Membership at the end of 1960 was 5,302, an increase of 430 over the previous year. One of the most important tasks in which the Institution is at present engaged is, quite naturally, education. The annual report points out that whereas in 1949 only 99 chemical engineers were qualified at British universities and technical colleges, this number had risen to 489 in 1959. This country therefore has the third largest output of chemical engineers in the world after the Soviet Union and the U.S.A. Nevertheless this output has not risen at the expected rate. In 1956 it was estimated that by 1959, 727 chemical engineers would qualify in this country as compared with the actual figure of 498. It may therefore well be that estimates for chemical engineers who will qualify in 1962 and 1965 are also too high (these were given as 875 and 1,052 respectively).

At the annual dinner of the Institution, the outgoing president, Mr. W. K. Hutchinson, remarked that in our society official recognition of the importance of engineering to the national wellbeing has done little to eradicate the popular image of the engineer as a man of few words—those usually rude—and less culture; his status symbol being a slide rule. "Are not we, the engineers, to blame for this?" asked Mr. Hutchinson. "The government obtains the opinion of organised industry and trade unions before making up its mind about subjects as diverse as disarmament and the opening of public houses, yet the professional and managerial classes have not yet made up their minds about the metric system."

The significant lack of status of engineers (including, of course, chemical engineers) seems to bear little relation to their dire shortage at present. The very fact that in the public eye an engineer can be anything from a professor to a member of the Amalgamated Engineering Union is evidence of the current confusion. This ignorance might well be caused by the fragmentation of the various branches of engineering into different professional bodies. Should there be an "Engineering Council" akin perhaps to the British Medical Association, whose task would be to safeguard professional status of engineers and to "put over" to the public the right image of an engineer, whether he be chemical, mechanical, electrical or civil. This, in the long run is the only way by which the dignity and status of the engineer in our society can be raised, and without the right "status" young people will never be attracted in sufficient numbers into this vital profession.

Brilliant biochemist

BORN at Eastbourne, Sussex, 100 years ago on June 20, Frederick Gowland Hopkins will ever be associated with the recognition of vitamins, even though professional chemists will recognise his wider rôle as a founder of biochemistry. Though the early death of his father meant that as a youth he went as assistant to a public analyst and then to the Home Office analyst's department, Hopkins got to Guy's Hospital for a medical career and research in the medical school. This was the prelude to his Cambridge days when from the physiology department he went to the first chair of biochemistry and built a first-rate school. He became F.R.S. in 1905, and later president of the Royal Society. His Nobel Prize in 1929 was awarded for the discovery of "growth-promoting vitamins." Hopkins wrote no textbook yet his many papers more than made up for this.

This brilliant biochemist began with butterflies; the wing pigments fascinated him and resulted in studies of the pterins and their structural relationship to uric acid. Hopkins introduced a method of estimating uric acid and went on to study its excretion in diseases and the effect of various diets on its metabolic production. Widening his interests he turned to an enzyme in milk, to proteins, to their estimation and efforts to crystallise them. In his new technique he isolated tryptophane from digests of protein, and in 1906 discovered zein as the sole protein unable to maintain growth of mice. This led to the idea that tryptophane was a normal precursor of some "hormone" or other agent in the body and to the belief in "essential amino-acids" in proteins. More protein researches and work on enzymes came later, with studies on lactic acid related to muscle contraction, and his discovery of glutathione and its difficult isolation. In his great

work on vitamins Hopkins used carefully purified synthetic diets, added meat or yeast extract to give flavour, and noted how rats flourished from such additions yet lost weight without them. Owing to his lack of success in isolating the active principles he did not publish his vitamin theories until 1912, a year which marked the beginning of modern theory and which brought much scepticism and opposition to his views. The first world war saw Gowland Hopkins actively engaged on diet and nutrition, out to show that mere calories were not enough.

So on this anniversary the rôle of this pioneer is seen more completely. His work forms a vital chapter in that remarkable story opening with scurvy and fruit juices, with Tasaki's beriberi and the contributions of Eijkman, and then on to biochemists like Lunin, Pekelharing and " G.H." himself.

Chemical thermodynamics

THE science of " chemical thermodynamics " is concerned with the measurement of heat effects of chemical reactions as well as of electrochemical reactions and of equilibria between a solid and the vapour it forms. The numerical information obtained by these measurements is condensed into tables listing the so-called standard heats of formation, entropies and specific heats of all pure substances such as metals, alloys, oxides, nitrides, sulphides, etc. These tables can be used to assist other laboratory work along similar lines intended to achieve a deeper understanding of the nature of the atomic bonding in alloys and other inorganic substances.

The practical significance of thermochemical data lies in the fact that they can be used to calculate various equilibria attained or encountered in the production and refining of metals and alloys, in particular at high temperatures. The data enable us, for example, to calculate the extent to which a certain agent would reduce a certain ore to produce the metal, or the extent to which a liquid alloy would pick up impurities from a given refractory used as the container. Present industrial developments require metals of ever-increasing purity, and here again thermochemical calculations help to assess the value of methods for the refining of that metal. Phase relationships in alloy systems the knowledge of which is fundamental to all metallurgical work can also be calculated from thermochemical data.

Large-scale industrial processes can be based on information obtained from thermochemical considerations and considerable expenditure on empirical research thus saved. Similarly, ways can be indicated to improve existing processes. The final development of such processes rests, of course, with the engineer who has to put the knowledge calculated on paper into practice.

This application of thermochemical calculations to industrial problems is still in its early stages, but gradual progress is being made. The National Physical Laboratory contributes to this progress by devising new methods for the determination of the required data, by collecting and assessing the information published in this field by other laboratories, and by demonstrating their potential usefulness to scientists in industry. A recent achievement at the N.P.L. is the construction of a calorimeter for slow reactions at temperatures up to 1,300°C.

Drug addiction declines

THE committee led by Sir Russell Brain which has been investigating drug addiction in Britain has come to the conclusion* that the number of addicts is still very small—454 known addicts compared with 616 in 1936—and that there is no likelihood of the number increasing seriously. The committee has been faced with a range of drugs unknown at the time of its predecessor, the Rolleston committee of 1926 which had to deal only with heroin and morphine. Today addicts indulge in synthetic drugs the number and range of which is increasing all the time. This has led to a demand that manufacturers should withhold new potentially addictive analgesics from distribution until they are approved by a central authority. The committee rejects this view, but says that any drug likely to be addictive should be tested for this possibility by the manufacturers before being released.

A new problem is the increasing use of sedatives, hypnotics, tranquillisers and stimulants. Between 1951 and 1959 the quantity of barbiturates prescribed under the Health Service increased from 90,000 lb. to 162,000 lb. Barbiturates, other sedatives and hypnotics, together with analgesics and antipyretics (excluding dangerous drugs) accounted for no less than 19% of all prescriptions issued in 1959. Tranquilliser consumption has also increased. There are no statistics for purchases of C.N.S. drugs without prescription, but the committee believes that the recommendation made in its interim report that as many as possible should be made prescription drugs has reduced this type of self-medication.

The increase in the use of C.N.S. drugs is attributed partly to manufacturers who have promoted them vigorously and partly to the current popular belief that every deviation from health must be countered with a specific chemical corrective. But in spite of the dangers of excessive use of C.N.S. drugs the committee emphasises their great value in psychiatry and in the treatment of mental disorders. They enable more patients to be treated at home and enable many to lead useful lives. " If the prescribing of even habit-forming drugs has contributed to this state of affairs it is to be condoned rather than condemned." Nevertheless the committee believes there is scope and need for operational research into the prescribing patterns in this country, with particular reference to habit-forming drugs.

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Output Replaces Imports and Provides Exports

By W. G. Norris

Another British plant for making hard gelatin capsules has been brought into operation by Parke, Davis and Co. at their Hounslow factory. Output—from two machines—is upwards of 300 million a year. Provision for extra capacity has been made in anticipation of still greater demands for encapsulated products.

IN the past few years there has been a sharp increase in the range and variety of drugs presented in hard gelatin capsules. Capsules are an elegant, attractive and precise means of dispensing drugs. Since the drug is not compressed, it disintegrates more easily than a tablet. Some people find capsules easier to swallow than tablets. Capsules are made in upwards of 50 colours, so a very large number of permutations can be achieved with caps and bodies of different colours. This enables an encapsulated drug and its manufacturer to be identified readily.

The hard gelatin capsule, although a British invention, has become a peculiarly American speciality. The first plant to be set up in Britain, in 1952, was installed by Eli Lilly and Co. at their Basingstoke factory. The second plant also belongs to a subsidiary of an American company, namely Parke, Davis and Co. of Hounslow, Middlesex.

PD have been operating in Britain for 70 years, longer than some British drug companies have been in existence. The 1,500 employees are British, from the general manager, Mr. L. O. Smith, downwards. The company has a large measure of independence of the parent company in Detroit. For instance, it recently marketed a new anti-cholinergic—*Portyn*—which was discovered and developed entirely at Hounslow.

Until last year, however, Hounslow had to import hard capsules from Detroit at the cost of many thousands of dollars a year. The installation of the new capsule plant, although costing many thousands of pounds, is immediately saving dollars while providing useful exports. About 30% of the 300 million capsules made by PD each year are sold to other manufacturers, either empty or filled. The rest are used by PD for their own products.

There are three main differences between the Lilly plant, as described in MANUFACTURING CHEMIST (June 1959), and PD's plant. At Hounslow the machines are much bigger (over four times the output), some capsules are printed, and a large proportion of these capsules are banded by the *Kapseal* process, which is exclusive to PD. Otherwise there are features similar or even identical in both plants.

Air conditioning—a basic requirement

Superficially the manufacture of hard gelatin capsules is simple. Gelatin is melted and aged, cast on stainless steel pins to form capsules which are dried, stripped off, trimmed, mated and ejected as complete two-piece assemblies. In fact these simple looking processes are complex and fraught with hazards.

Gelatin is a natural substance subject to bacterial spoilage and other maladies and it is very hygroscopic. Success, therefore, depends on using gelatin of a uniform composition and viscosity, on split second timing of casting and drying, and, above all, on maintaining the air in the plant at a constant humidity and temperature. The air conditioning plants at Hounslow, which serve the ground and first floors of the 18,000 sq. ft. building, are of the lithium chloride type (the American *Kathabar* system). Together with pumps and compressors and vacuum pumps for filling operations, they weigh 20 tons. They provide 40,000 cubic feet of air per minute, nine-tenths of which is recirculated, with the balance made up. The capsule making machines are sited on the ground floor in a hall of 40,000 cu. ft. in which the air is changed every 7-8 min., maintaining a relative humidity of 50% at 71°F.



INSPECTION. **Every capsule is inspected over an illuminated glass aperture. Bubbles, dents, specks, bad trimming and loose caps are among the faults looked for.**

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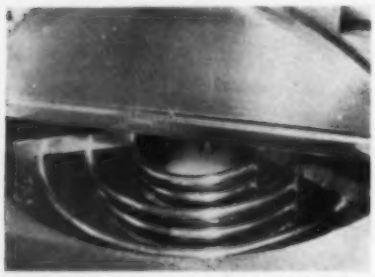


INSPECTION. **Every capsule is inspected over an illuminated glass aperture. Bubbles, dents, specks, bad trimming and loose caps are among the faults looked for.**

Gelatin preparation

The first step is to melt gelatin.

This is done in a room next to a store with a capacity of ten tons of gelatin, of which about 5,000 lb. are used each month. After analytical check for bloom, viscosity, colour, *p*H, ash, SO_2, arsenic, heavy metals and bacteria, gelatin is soaked in demineralised water in a stainless steel vessel. Demineralised water is necessary to maintain the ash content of the gelatin solution at a minimum. A high ash value in the gelatin solution has a deleterious effect on the drying and trimming of the capsules. The soaked gelatin is transferred by hoist to a 100-gal. s.s. melting vessel. In addition to a hot-water jacket it contains concentric hot-water pipes. Melted gelatin is poured into 60-gal. s.s. tanks through a nylon bag. In these filtered gelatin is aged for 8 hr. to allow it to de-aerate and become more stable. During ageing a layer of bubbles forms on the surface and is removed before the gelatin is poured into 20-gal. s.s. feed tanks mounted on bogies. These are electrically heated to 120°F.





GELATIN PREPARATION. **Above: The interior of the 100-gal. stainless steel melting vessel which, in addition to being water jacketed, has concentric hot-water pipes. Below: From the melting tank the gelatin pours into 60-gal. tanks for ageing, from whence it is transferred to 20-gal. mobile feed tanks.**



CAPSULE MACHINES. **The two machines are each capable of producing 22,500 capsules every 45 min., this time corresponding to the drying cycle. Roughly one pint of gelatin is used for every 2,000 capsules.**

The density of the gelatin is adjusted with a Baumé hydrometer by adding water. Average density is 11 Bé., depending on the size of the capsules being made; large capsules require a more viscous jelly than small ones. The gelatin is then coloured, the basic dyes used being blue, yellow and three reds. Titanium dioxide is added to jelly to make opaque capsules. The gelatin is then wheeled to the adjacent machine hall.

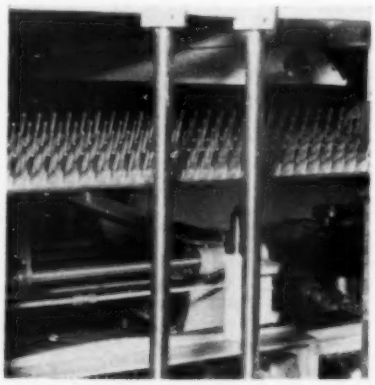
The capsule machines

The two machines are each 40 ft. long. On one side of the machine caps are cast, dried and finished and on the other side bodies are similarly processed. The equipment on one side is thus duplicated on the other. The mechanical end consists of dipping unit and finishing unit (unscrambler, stripper, etc.). The dipped pins travel to the upper drying deck, where they pass under two kilns. At the end of the machine they return to the lower deck and pass under a third drying kiln and finally under a kiln where the pins are cooled. By this time they have returned to the mechanical end where they are finished.

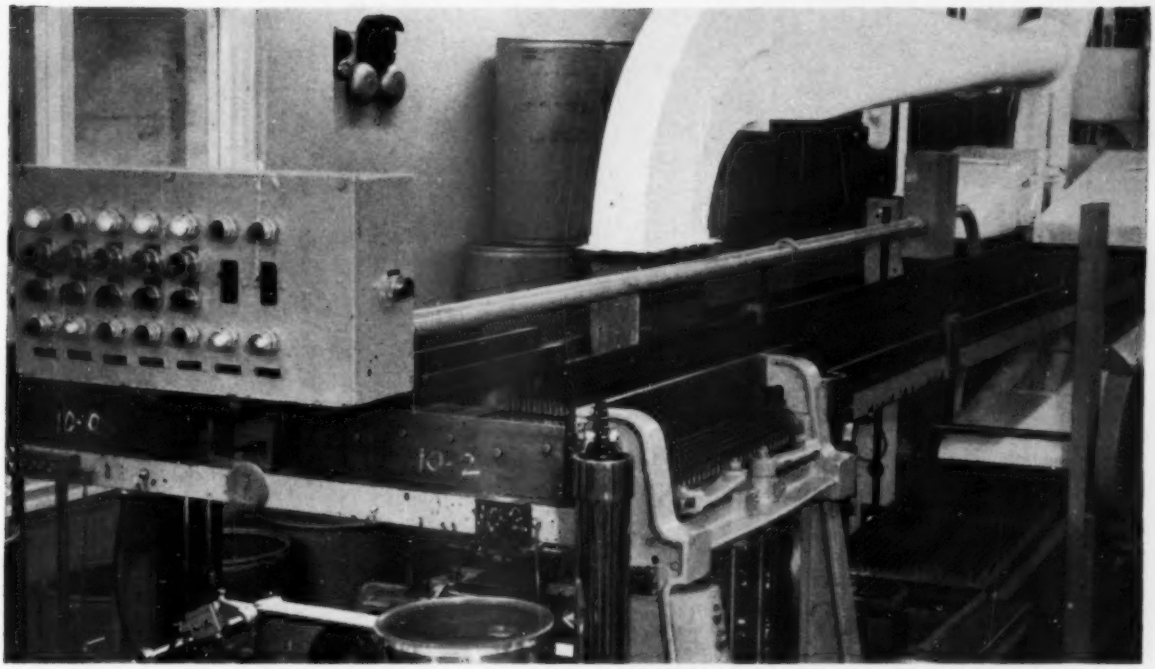
Two 2-gal. gelatin reservoirs, known as bubble tanks, are fitted to each machine. One feeds the dip dish for the body pins, the other the dish for the cap pins so that two different colours can be run simultaneously. About 2 gal. of gelatin are used each hour. The amount of gelatin used per thousand capsules can be judged by the fact that every 45 min. (the drying cycle) 22,500 capsules are produced. It works out at roughly one pint per 2,000 capsules.

The dip dishes are hot-water jacketed and copper lined. Fitted inside is a bronze inner dish in which the level of gelatin is maintained by a weir effect. This is very important because the casting pins are adjusted to dip only a certain depth into the gelatin. Automatic levelling devices make it unnecessary to top up the bubble tanks more than once an hour.

Each bar bears 30 stainless steel casting pins. There are 750 pairs of bars, each pair producing bodies and caps respectively. A tolerance of



DIPPING. **Body pins of the capsule machine. After dipping they rotate upwards to distribute gelatin evenly.**



CAPSULE MACHINE. **This photo shows the control panel and the upper deck arrangement of the dipped pins at the start of the drying cycle.**

± 0·00025 in. is maintained on the double wall thickness.

The bars are assembled and dipped in groups of five each side of the machine. Timing of the dip is critical; upon it depends the distribution of the gelatin film. Proper distribution is further assisted by moving the dipped bars upwards with a revolving motion. On the top deck of the machine the bars are assembled in groups of 20 each side and progress slowly through the kilns. In the drying kilns air at 72°-80°F is blown at 20 p.s.i. through a screen containing perforations corresponding to the location of the pins. Thus each capsule gets an individual air blast.

After about 40 min. the capsules are hard and ready for stripping. Before this they pass under the final kilns which cool the pins to assist stripping.

The assemblies of bars are unscrambled by mechanical fingers and presented in turn to a stripping device consisting of a row of 30 tiny claws which grip the pins behind the capsules and pull the capsules into a row of collets. Here they are trimmed by being rotated against a tungsten blade and ejected into a joiner block where cap and body are perfectly mated and thrust from the machine in a steady stream of capsules.

The stripped pins are polished and lubricated by being revolved in felt lined sockets and then go on to the next cycle of dipping and drying.

During manufacture regular checks are made of dip dish temperature, colour of capsules—with a G.E.C. colour matching cabinet—kiln temperature and film distribution on the pins.

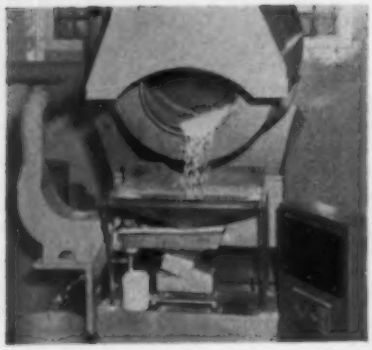
The machine is a masterpiece of timing; it is an engineer's paradise, from the strippers to the automatic lubrication. Each impressive monster is driven by a one h.p. electric motor.

Inspection

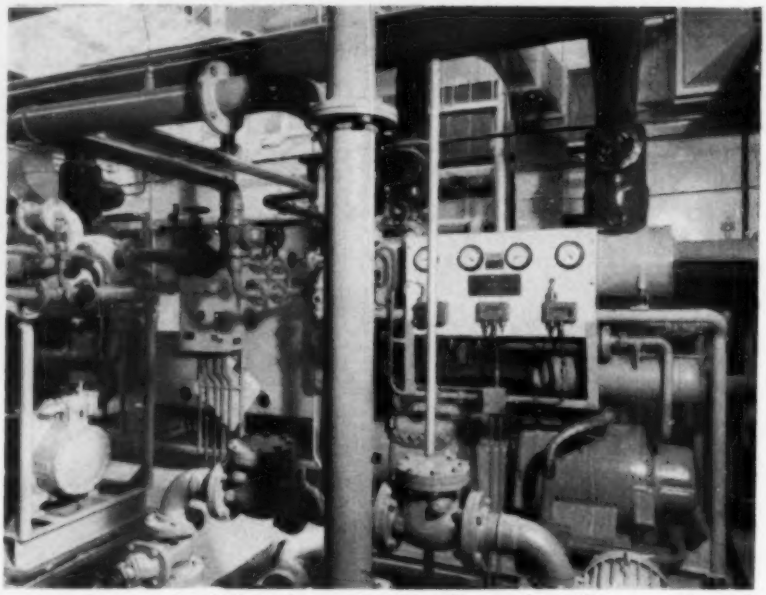
Every capsule is inspected by women "pickers" who examine them over an illuminated glass aperture. Bubbles, dents, specks, bad trimming and loose caps are among the faults looked for. The inspected empty



FILLING. **This machine can fill eight sizes of capsule.**



TUMBLER-POLISHER. **Filled capsules are placed in this rotating drum and polished with a powder, after which they are cleaned by vibration.**



AIR-CONDITIONING **is vital to the production of capsules. Here is a view of the complex air conditioning plant with the refrigeration unit in the foreground.**

capsules are packed into large polythene lined fibreboard drums and put into store, from whence they are either dispatched to customers or sent to the filling and banding departments. One drum holds 500,000 of the smallest or 100,000 of the largest capsules. Records of all batches are kept in minute detail.

Filling

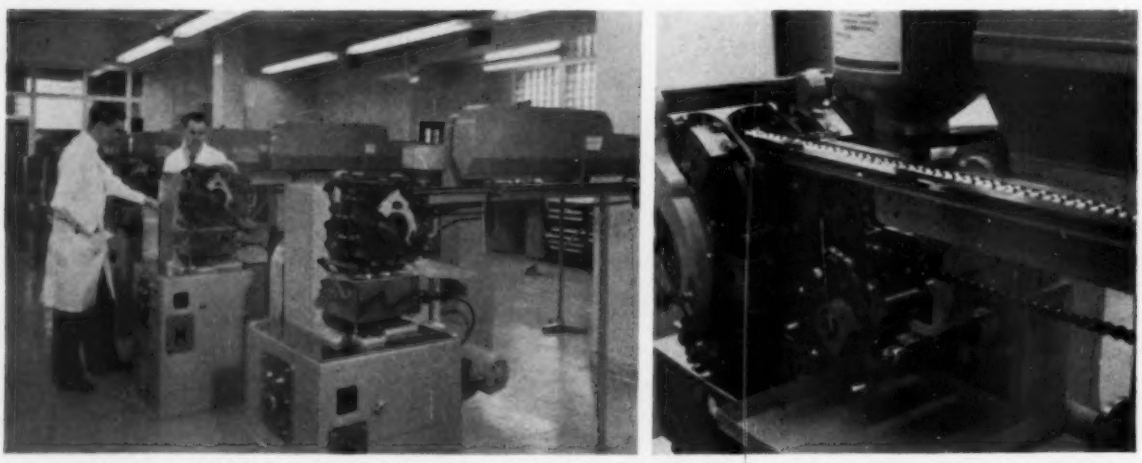
Machines for filling are of the Colton type and can handle eight sizes. The capsules are fed into holes drilled in a pair of discs. They pass through a tapered raceway so that they swivel downwards, entering the holes body first. A lip on the top disc engages the edge of the cap and draws it into the top disc, leaving the bottom filled with the open bodies. These are filled by rotating under a powder hopper, after which the two discs are paired and placed in a chuck which is closed by compressed air, joining the capsules and ejecting them over a vibrating belt to shake off surplus powder.

Adjustments can be made to the machines to offset any variations in the density of the powders. Thus the correct dosage of drug per capsule is maintained. Sample checks of weights of filled capsules are made constantly.

Polishing

Filled capsules are placed in a tumbler polisher consisting of a rotating drum with a perforated lining. A powder (salt, magnesium stearate and starch) cascades through the liner on to the tumbling mass of capsules, polishing them and removing any powdered drug clinging to the outside. Polished capsules drop on to a vibrating belt to shake off surplus polishing powder which is collected and recycled. The capsules travel to a receptacle against an air stream adjusted to blow out empty or underfilled capsules. This

(*Continued on page* 258)



KAPSEAL MACHINES. **Left: Some of the 15 banding machines, arranged head to toe, to facilitate supervision. Right: Close-up of the mechanism which applies band of gelatin to capsules.**

Small-scale Processing Machinery

The demands of modern production make it necessary to examine carefully every operation in pharmaceutical manufacturing. This is especially true of drying, partly because it has come into wider use, for example for drying tablet granules, but also because of new products which are very sensitive to moisture and heat. Such substances have made it necessary to modify existing methods and even to devise new procedures. The selection of dryers for small-scale pharmaceutical manufacturing is difficult, owing to the great variety of materials to be processed and the large number of dryers on the market. In this article Mr. Fowler first discusses the theory of drying and then deals with mechanical and convection dryers. Conduction and radiation dryers will be considered in the second part of the article to be published next month.*

DRYERS

1—Mechanical and Convection Dryers

By H. W. Fowler,† B.Pharm., F.P.S.

MATERIALS which may require drying can be divided into four main groups: *a*. Substances undergoing analysis. Such work requires close control of drying conditions to give consistent results, but this article is concerned with production, so analysis will not receive further consideration. *b*. Apparatus such as glassware, ampoules, hypodermic syringes, etc. *c*. Moist solids, *e.g.* fresh drugs, powders, granules, etc. *d*. Dilute solutions or suspensions from which a dry product is required.

Some processes under groups *b* and *c* may be a preliminary to sterilisation by heat, and it is often advantageous to have equipment in which both of these operations may be carried out.

Thus, in common with most small-scale pharmaceutical apparatus, a dryer should be: *a*. versatile and capable of being adapted to different materials; *b*. controllable to the required working conditions for the particular material; *c*. readily cleaned to avoid contamination of succeeding batches; *d*. easily maintained, without the need for a skilled mechanic; *e*. of reasonable cost.

Theory of drying

Before considering the theory of drying and dryers, what is meant by the term "dry"? For some products this may require the complete absence of liquid (commonly water). In many cases, however, the substance is reduced to an Equilibrium Moisture Content, which is the moisture content of the material when it is in equilibrium with an atmosphere of a particular temperature and humidity. This equilibrium moisture content varies with different materials, as illustrated in Fig. 1, being generally low with non-porous solids, but higher and variable with materials which are fibrous, cellular, colloidal or of organic origin. Thus, the "dryness" of the substance will depend upon the conditions of temperature and humidity at the product outlet of the dryer. It must be remembered, however, that irrespective of the dryness of the product when leaving the dryer, if the substance is left in contact with normal atmospheric conditions a "moisture regain" will occur until a new equilibrium has been set up. Hence it is normally unnecessary to continue the drying process to a point beyond the moisture content of the substance when in equilibrium with normal atmospheric conditions, and inspection of Fig. 1 will show that "air-dry" crude drugs or surgical dressings may have a moisture content of the order of 15-20%. Exceptions to this occur and antibiotics, for example, must have zero moisture content and the dry product is immediately packaged without exposure to the atmosphere.

In order to provide a constant basis for comparison, moisture contents are normally expressed as "dry basis," that is, the moisture is stated as a percentage or as a proportion of the dry material.

Drying may be done mechanically where the liquid is removed without heat, or thermally, where the liquid is vaporised by heating and the vapour then removed.

Mechanical drying

The increasing popularity of the spin dryer for domestic use emphasises the value of using mechanical drying where possible. Two advantages may be mentioned. Firstly it is very rapid, and secondly the liquid is removed, together with any dissolved material. This latter is essential when crystals are being dried to avoid the deposition of

* Fourth in the MANUFACTURING CHEMIST series. 1. Emulsifying Machinery appeared in March, 2. Mills and Sieves in April and 3. Tableting Machinery in May.

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solids from the mother liquor, but is advantageous in other cases.

The efficiency of the centrifuge in terms of its separating power is measured by the "centrifugal effect," that is, the ratio of the centrifugal to the gravitational force, and it can be shown[1] that the centrifugal effect is given by the expression:

$$\text{Centrifugal effect} = 0{\cdot}613\ N^2D \quad \ldots\ (1)$$

where N = revolutions/second,
D = diameter of centrifuge in feet.

Industrial size centrifuges are commonly about 3 ft. in diameter and operate at about 1,000 r.p.m.; substitution in equation 1 will show that this gives a centrifugal effect of approximately 500. Similar conditions may be obtained on the small scale by the use of a smaller centrifuge at a higher speed; for example, equation 1 shows that a 9 in. diameter laboratory centrifuge operating at 2,000 r.p.m. or a 4 in. diameter model working at 3,000 r.p.m. will give the same centrifugal effect.

It will be apparent that if greater centrifugal effects are required it is preferable to use a smaller centrifuge at high speed rather than to increase the centrifugal effect by using a larger centrifuge at a low speed. Furthermore, it can be shown that the stress in the metal of the centrifuge basket is proportional to the peripheral speed,[1] which will increase greatly as the basket diameter increases. The results of this can be illustrated by using published charts[2] to obtain the centrifugally produced pressures for water in the three centrifuges quoted above and the values are shown in Table 1.

Table 1

Centrifuge diameter (inches)	*Speed of rotation* (r.p.m.)	*Centrifugal effect*	*Pressure due to water* (p.s.i.)
4	3,000	510	19
9	2,000	510	36
36	1,000	510	126

These figures emphasise that a centrifuge is subject to conditions similar to an autoclave or pressure vessel and it must be treated with similar respect. Such equipment is completely safe; the original design will take account of these pressures, but suitable maintenance and avoidance of corrosion are essential. Centrifuges must be operated carefully; for example, if an interlocking switch is not fitted the centrifuge should not be started until the cover is closed and the basket allowed to come to rest before opening the cover.

Thermal drying

Thermal drying depends upon vaporisation of the liquid, with subsequent removal of the vapour. The process is dependent upon: *a.* heat transfer, to effect vaporisation; and *b.* removal of the vapour.

The actual rate of drying will be governed by an equilibrium set up between these two factors.

Heat can be transferred by any one of, or by a combination of, three methods—convection, conduction or radiation. All will enter into the heat transfer mechanism of any dryer to some extent, but, in general, it will be found that the dryer is designed to utilise one principal method. Thus, in an ordinary oven most of the heat will be transferred by convection although, in addition, there will be conduction from the shelves and radiation from the walls.

The main method of heat transfer used in dryers provides a convenient system of classification. I shall deal with convection dryers in this article and with conduction and radiation dryers in a later article.

Heat transfer in convection dryers. It can be shown[2] that the heat transfer coefficient in forced convection is given by:

$$h_c = 0{\cdot}0128\ G^{0{\cdot}8} \quad \ldots\ (2)$$

where h_c = convection heat transfer coefficient (Btu/hr./ft.²/°F.)
G = mass velocity of dry air (lb./hr./ft.²)

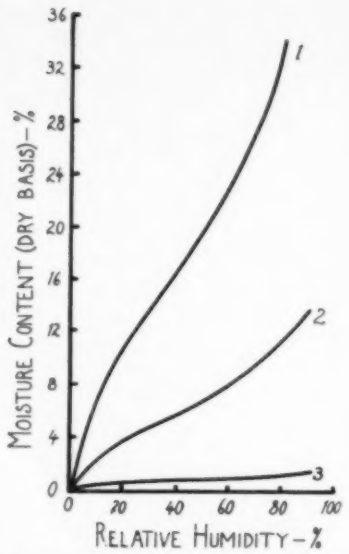


Fig. 1. Typical curves showing the equilibrium moisture contents of various materials at different relative humidities. Curve 1. A vegetable leaf. Curve 2. Cotton cloth. Curve 3. Kaolin.

Thus, within limits, the stream of heated air should move as rapidly as possible, the limiting factor being the velocity at which solid matter is entrained, unless the dryer is designed to avoid loss of material in the air stream.

Vapour removal. The vapour will be formed at the actual surface of the solid, whence it must escape through the air boundary layer. This

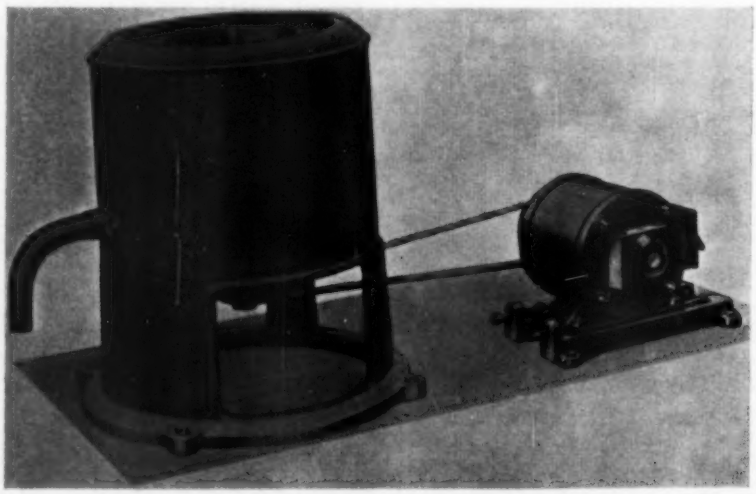


Fig. 2. Laboratory centrifuge 9 in. Broadbent, Type 41. (Thomas Broadbent and Sons Ltd., Huddersfield.)

will occur by diffusion and, from Fick's law, the controlling variables will be the thickness of the air boundary layer and the vapour pressure gradient across the layer. Both factors will be affected by increased air velocities, the boundary layer being reduced in thickness if flow conditions are turbulent and the vapour pressure gradient being kept maximum if the humidity of the atmosphere is minimised by removal of the vapour. The drying rate, therefore, has this second link with the mass velocity of the air stream, and an equation analogous to (2) applies.

In some cases, however, it may be desirable to control the air humidity at a relatively high value, so reducing the drying rate. Materials such as gelatine solutions will form a "skin" if dried too quickly, so hindering the later stages of drying. "Case-hardening" may be avoided by using air of higher humidity.

Increased humidity caused by lack of ventilation may have harmful effects on some products, and Iles and Sharman[3] found that inadequate ventilation influenced the results of drying processes, the effect in this case being on the constitutents of tobacco, but it is likely that crude drugs may be similarly affected.

Drying rates. When moisture is being dried from a bed of solid material the drying rate varies during different stages of drying.

At first, the loss in weight occurs uniformly, that is, the drying rate is constant. This takes place because the bed of solids is saturated and liquid moves from below by capillary action to replace the surface liquid as it is vaporised.

In later stages of drying, the rate decreases, the reason being that the bed is not then saturated, the liquid films on the surface of the particles are no longer continuous and the liquid cannot be carried to the surface of the bed. Vaporisation therefore must take place below the surface and the plane of vaporisation retreats continually into the bed of solid, resulting in an increased distance over which vapour must diffuse. The rate at which vapour diffusion can occur becomes the controlling factor and the drying rate decreases until the equilibrium moisture content is reached.

The moisture content at which the constant rate period ends is known as the critical moisture content, the value of which will depend upon the properties of the material, being low in the case of non-porous solids (such as sand) and higher if the substance has a porous or cellular structure, etc.

Temperatures during drying. Many pharmaceutical substances are thermolabile, the instability commonly being enhanced by the presence of moisture, so that it is important that careful attention should be given to temperatures during drying.

During the constant rate period, the surface of the solid will attain a temperature approximating to the wet bulb temperature. Thus, if the dry bulb temperature of the air stream is known, the wet bulb temperature can be obtained from standard psychrometric charts (as given for example in Perry[2]) and will give an estimate of the drying temperature, although the actual temperature in practice is normally slightly higher owing to radiation and conduction errors.

The equilibrium between the transfer of sensible heat from the air and the latent heat carried away by the vapour (which causes the drying solid to be maintained at the wet bulb temperature) will be disturbed at the end of the constant rate period. The drying rate decreases as the falling rate period is entered, so that the heat carried away as latent heat will be less, and sensible heat is transferred to the solid, causing a rise in temperature. This will continue until the substance reaches its equilibrium moisture content, the temperature of the solid then



Fig. 3. Townson and Mercer even heat oven.

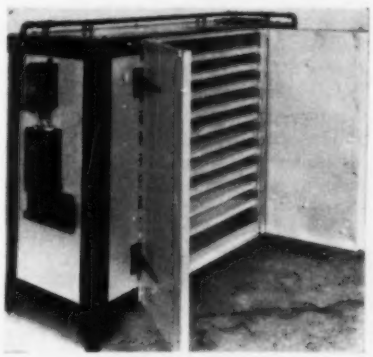


Fig. 4. Mitchell standard hot-air drying cabinet.

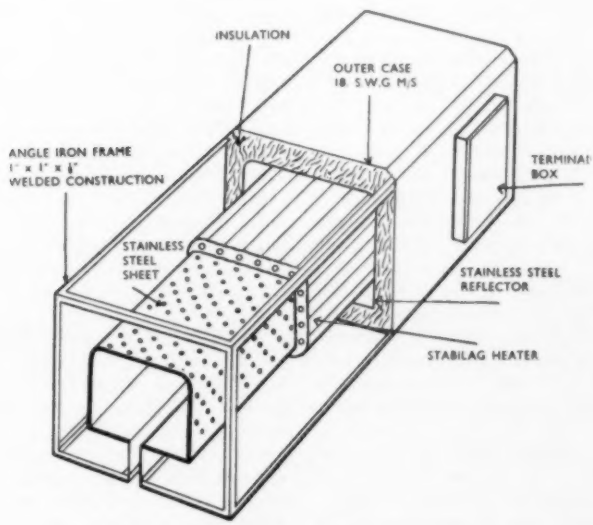


Fig. 5. Stabilag electrically heated tunnel units.

approximating to the dry bulb temperature of the oven. In practice, it may be advantageous to reduce the air temperature at the end of the constant rate period, although against this is the fact that many materials can safely withstand higher temperatures when the moisture content has been reduced.

It should also be borne in mind that temperature variations may occur within certain types of dryer, giving consequent risk of overheating. Laboratory ovens, for example, are the subject of a British Standard Specification[4] which requires that the temperature variation in the oven shall not exceed 2·5°C., but this applies to empty ovens only. When the oven is loaded, the air flow may be restricted and the variation is likely to be greater. Darmady and Brock[5] in work on hot-air ovens for sterilisation showed that temperature variations in heavily loaded ovens could be as high as 40°C., and it is possible that similar variations could occur in drying ovens. It is important, therefore, to ensure that the dryer is not overloaded and that the load does not obstruct the free movement of the air stream.

Mechanical dryers

Centrifuges used for drying consist of a perforated cylindrical basket which can be rotated within a protecting casing. Access to the basket is normally through the top of the casing and, although this is not always the case, it is desirable to have a cover fitted, preferably with an interlocking switch, so that the centrifuge cannot be operated unless the cover is closed.

A speed control (preferably with a tachometer) is useful, enabling the centrifugal effect to be varied as necessary for different materials. In use, the basket is lined with a suitable material, such as filter cloth, and the moist solid is introduced. Speed is increased gradually, so that the solid forms a uniform layer over the inside of the basket. Uneven loading will cause excessive vibration.

Convection dryers

Shelf, compartment or tray dryers. These dryers are variously described, but are probably the simplest and most versatile, being merely a compartment or cabinet with a source of heat and shelves on which articles or trays may be placed.

The smaller versions are commonly described as laboratory ovens and vary from inexpensive models with heating elements only and relying upon natural convection, to accurately controlled ovens, with forced convection by fan, booster heaters, air vents, etc. The latter type, while giving better conditions, are still not ideal for drying, being designed to carry out heating processes in general and so being suitable for operations such as sterilisation as well as drying.

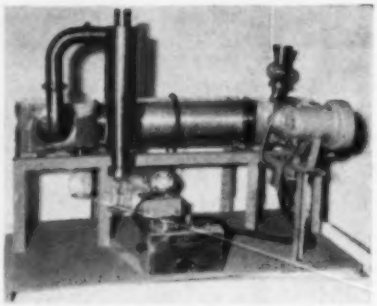


Fig. 6. Benco small-scale rotary dryer.

The slightly larger, pilot-scale units are actually designed as dryers and give the best possible conditions for drying. The air stream is *directed* to pass over the material instead of relying on a general circulation. Furthermore, the air is drawn in from and exhausted to the atmosphere, so maintaining the lowest possible humidity. Dampers, however, enable recirculation to be carried out if desired, effecting firstly thermal economy and secondly control of air humidity and thereby of drying rates.

The versatility of this type of dryer means that they may be used for almost any type of process and can deal satisfactorily with most materials.

Tunnel dryers. These are essentially similar to compartment dryers but are arranged so that materials may be passed through the dryer, for example, on trays which are pushed through by hand, or mechanically by conveyor belt. The method may be applied to small-scale continuous production or for development work between the laboratory oven and the large-scale dryer.

Like compartment dryers, the tunnel dryer is suitable for application to almost any drying process.

Through-circulation dryers. In the previous cases the air stream passes over the surface of a bed of the solid. In through-circulation dryers the air is caused to pass *through* the solids.

The method is particularly useful with powders or granular substances, especially if it is a material which cakes if dried undisturbed on a tray in a compartment dryer. The air stream may be given sufficient velocity to fluidise the solid bed, that is, to suspend the particles so that they behave in a manner similar to a fluid. Thus the particles are no longer stagnant but move freely and caking is avoided. In dryers of this type the falling rate period is almost completely eliminated, practically all moisture being removed under constant rate conditions.

Rotary dryers. These utilise a rotating cylinder, arranged with a slight slope so that materials introduced at the higher end will be conveyed gradually to the lower end. Hot air passes through the cylinder, usually countercurrent to the solids. Powders and granular solids may again be produced in a free-flowing state and the turbulence of the particles enhances the drying rates.

Spray dryers. Dilute solutions or suspensions are quickly reduced to a free-flowing powder by spray drying. In this process the liquid is atomised into a stream of hot air, each individual droplet rapidly drying to a particle of solid. Uniform droplet size is essential to give satisfactory drying, and rotating disc atomisers have been found better in this respect than jet atomisers.

It is an excellent method for thermolabile materials, the small droplets and large area giving high vaporisation rates. Thus the drying time may be as short as 2-3 sec. and the temperature does not rise appreciably, the heat being used as latent heat of vaporisation.

Spray drying is not suitable for small quantities of liquids, but the laboratory scale equipment is useful for small-scale production and for development work.

COMMERCIAL DRYERS

The following commercial dryers are quoted as *examples* of the general groups discussed in the previous sections. The manufacturers referred to are not necessarily the only makers of such equipment, nor does the fact that a particular make is described necessarily imply that it is the best.

Centrifuges

Laboratory centrifuges are normally in the range of 4-9 in. diameter and the Broadbent 9 in. type 41 centrifuge (Fig. 2) is typical. The basket may be obtained in aluminium, stainless steel or rubber-lined steel according to the required duty and similar materials are used for the casing. No speed is specified by the manufacturer as the centrifuge is belt driven from a commercial motor, which may be operated at any suitable speed or may be fitted with variable speed.

The Broadbent 21 in. type 86 centrifuge, having a capacity of 1 cu. ft., is suitable for small-scale production involving the drying of powders or crystals. The operating speed is 1,300 r.p.m., giving a centrifugal effect of 505; the cover has feed and wash water inlets. For safety, the cover has an interlocking switch and a brake facilitates operation. Construction is normally in stainless steel to resist corrosion and avoid contamination.

Compartment dryers

A considerable number of the smaller compartment dryers — laboratory ovens — are available, different versions being made by most laboratory equipment manufacturers. However, none of the ovens known to the author possesses the ideal characteristics necessary for drying, which are considered to be as follows: *a*. accurate temperature control; *b*. minimal temperature variation within the dryer; *c*. forced convection, the fan having variable speed control; *d*. the air stream directed, so that it passes over the surface of the material; *e*. the air stream drawn from and exhausted to the atmosphere; *f*. control of the inlet and outlet vents, enabling the air to be partially or wholly re-circulated, if required.

Small ovens, such as the Griffin-Grundy laboratory oven, having a chamber of approximately 1 cu. ft. are available at less than £30. Temperature variation is claimed to be within ±7°C. and the temperature fluctuation as little as ±0·5°C. Vents are provided in both the base and the top of the oven.

Large ovens complying with the British Standard[4] are manufactured in the price range £80-£130, with capacities up to approximately 3 cu. ft., giving shelf areas of the order of 6 sq. ft. Examples include the B.T.L., the L.T.E. and the Hearson, all of which conform to the B.S. requirements for temperature variation, fluctuation, drift, overshoot, reproducibility, recovery time, etc. Models are available both with and without fan circulation.

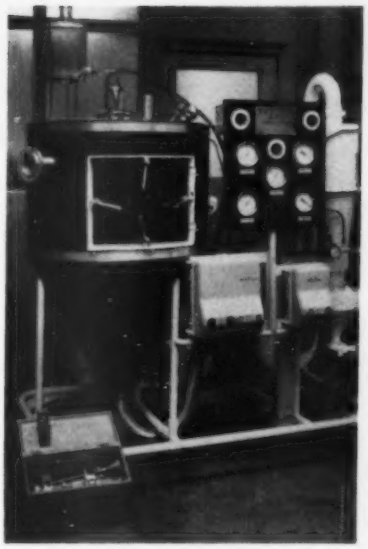


Fig. 7. Kestner laboratory spray dryer.

In my opinion the best drying conditions in the commercial ovens will be given by the Townson and Mercer Even Heat Oven (Fig. 3). The general operating conditions are similar, the difference lying in the fact that the oven has two vents, one being in the conventional position at the top centre of the chamber. The second tubulure is arranged to admit air from the atmosphere (through an aluminium tube in the insulation to pre-heat the air) to the eye of the circulating fan. Here it is mixed with air from the oven drawn into the fan at the centre back of the oven, the mixed air then passing behind the false back, to be admitted to the oven at the four corners. The amount of air entering the oven may be controlled by rotating the ventilator cap over the tubulure. The fan, false back, tubulures, etc., may be seen in Fig. 3. The fan is arranged to operate at one speed only and it would be advantageous to have a variable speed control.

It is thus possible to have a stream of air through the oven, giving improved vapour removal. The manufacturers state that this system permits 2½ changes of air per min. and that the drying of articles may be speeded by five times compared with normal circulation methods.

On a somewhat larger scale, it is possible to have equipment designed exclusively for drying and possessing the properties enumerated above. The Mitchell Tray Dryer (Fig. 4), for example, accommodates 10 trays giving a total tray area of approximately 35 square feet. Controlled temperatures can be arranged up to 250°C. with efficient air re-circulation, etc.

Tunnel dryers

Stabilag electrically heated tunnel units (Fig. 5) provide a means whereby tunnels of varying lengths may be obtained. Each unit consists of an inner metal tunnel, surrounded by heaters which in turn are enclosed by a reflector and insulation to reduce heat losses, with a final outer casing of mild steel.

These are available as units 3 ft. in length and the appropriate number may be joined together to form the required length of tunnel, along which the material is conveyed. A fan fitted at one end would provide a stream of air to remove vapour.

Through-circulation dryers

A dryer of the through-circulation type and employing a fluidised bed is now obtainable in this country, it is the *Aeromatic* dryer. Powders or granular materials are placed in a transparent container having a base of stainless steel wire mesh. Heated, filtered air is blown through the base of the vessel and so through the material, the velocity of the air being sufficient to fluidise the bed. Entrained particles are recovered by allowing the air to escape by passing through a nylon filter.

The speed of drying is indicated by the claim that the Aeromatic STR-5 accommodates a load of 11 lb. of material which can be dried from 20% moisture content in 30-40 min. at a maximum drying temperature of 122°F.

The method is especially suitable for tablet granules, particularly if the materials are thermolabile.

Rotary dryers

A typical small-scale rotary dryer is the Benco (Fig. 6), which is capable of considerable variation of operating conditions. The actual dryer consists of a stainless steel cylinder 24 in. long and 4 in. in diameter. Air velocity may be varied between 100 and 900 ft. per

min. and air temperature controlled up to 500°F. Retention time in the dryer can be altered by changing the angle of slope of the cylinder and by adjustment of the speed of rotation. Internal lifting " flights " or baffles influence the turbulence of the material during drying and up to eight flights may be fitted, while the whole apparatus may be reversed so that the air flow may be parallel or countercurrent.

The dryer has a design capacity of 5 lb. per hr. although experiments have been carried out with as little as 4 oz. or as much as 17 lb. per hr.

Spray dryers

Laboratory spray dryers of a similar capacity are available from both Niro and Kestners. The Kestner unit is illustrated (Fig. 7).

The dryer uses a centrifugal atomiser, driven by an air turbine, and the atomised liquid is introduced into a stainless steel drying chamber 2 ft. 6 in. in diameter, together with a stream of air, suitably heated by gas, electricity or steam. The dried product is collected in a cyclone separator, with a bag filter for the recovery of fines.

The capacity will depend upon the circumstances, but the rate of vaporisation is of the order of 5-10 lb. per hr. of water, representing some 2 lb. per hr. of dry product.

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3. W. G. Iles and C. F. Sharman, *J. Soc. Chem. Ind.*, 1949, **68**, 174.
4. B.S.S. 2648: 1955.
5. E. M. Darmady and R. B. Brock, *J. Clin. Path.*, 1954, **7**, 290.

Part 2 of this article on dryers will deal firstly with the theory relating to heat transfer by conduction and with conduction dryers—vacuum and freeze dryers. It will also include the theory of radiant heat transmission and dryers utilising this method of heat transfer.

Emulsions and polishes. Durez Plastic division of the Hooker Chemical Corp. have now published in this country their new handbook entitled " Durez Resins in Polymer-type Floor Polishes," which contains all the latest U.S. information on polishes and polish formulations. Copies can be obtained from Omni (London) Ltd., 35 Dover Street, London, W.1.

P.D.'s NEW CAPSULE PLANT

(*Continued from page* 252)

is typical of the ingenious mechanical refinements one sees in the plant.

Banding

The *Kapseal* banding process is done on the upper floor. Fifteen banding machines, each about 14 ft. long, are arranged " head to toe " to enable one man to tend six machines without moving from one end to the other; he is thus responsible for feeding three machines and taking off capsules from three more. Capsules are banded by applying a strip of gelatin around the middle. They are fed from a hopper to a starwheel which grips them by their ends, leaving them free to revolve against a blade which applies a band of gelatin. The blade dips into a small tank of coloured gelatin, replenishing itself for each capsule. Banded capsules travel along a blast dryer using air at ambient temperature. Each machine bands 3,000 capsules or more per hour. Banding gelatin is of a higher viscosity and lower bloom than capsule gelatin. It is coloured, and the coloured band on the capsule is a registered trade mark of the company. Banded capsules are leak-proof and tamper-proof, preventing fraud in countries where business standards are questionable.

The 15 *Kapseal* machines were built to PD designs at Hounslow and are used exclusively for PD products.

Printing

Capsules are printed with edible ink on an American offset machine which has the fantastic output of a million a day. It is used at present only for white *Chloromycetin* capsules. The capsules are printed before being filled and the name " Parke Davis " on cap and body remains in alignment because during filling the capsules are not rotated.

Filled capsules are given a final sorting and polishing by hand by women wearing cotton gloves. The capsules are rolled over a raised nap cloth and a light sprinkling of carnauba wax gives a high gloss and reduces the tendency to brittleness.

PD use capsules for 26 products, including *Epanutin* (anti-epileptic), *Carbrital* (sedative-hypnotic), *Benadryl* (antihistamine) and *Chloromycetin* (antibiotic).



CAPSULE PRINTING. **This offset machine prints empty capsules at the rate of a million a day. Edible ink is used.**

Some Suppliers of Equipment

Stainless steel gelatin preparation vessels:
T. Giusti and Son Ltd.
Polishing machine:
John Docker and Co.
Colour matching cabinet:
G.E.C.
Counting machine:
John Docker and Co.
Air filters:
Vokes Ltd.
Demineralised water plant:
Permutit Co. Ltd.
Water coolers:
Heenan and Froude.

ANTIVIRAL ANTIBIOTICS

Three virus-inhibitory substances capable of acting without damaging the host cells are HBB (the hydroxybenzyl derivative of benzimidazole), helenine and interferon, according to I. Tamm (*News from Rockefeller Institute*, December, 1960).

HBB acts *in vitro* against polio, coxsackie, and echo viruses, three enteroviruses. Helenine is a nucleoprotein produced by the mould *Penicillium funiculosum*. It has shown some protective action in animals infected experimentally with influenza and encephalomyocarditis. It acts synergistically with small doses of immune serum.

The third substance, interferon, has the broadest antiviral spectrum, acting against enteroviruses, influenza, encephalitis, pox and other viruses. The main difficulty is to manufacture interferon in large quantities by biological processes; it is produced naturally by cells in response to virus infections (see Burke, MANUFACTURING CHEMIST, September 1960, pp. 383-3).

Veterinary Medicine Formulation

MILK-FEVER REMEDIES



Characteristic attitude of cow with milk fever. (From R. Seiden's *Livestock Health Encyclopædia.*)

By Rudolph Seiden, D.Sc.Tech., Ch.E., F.A.I.C.

Preparations for treating milk fever in cows and ewes form one of the largest groups of veterinary preparations. Calcium preparations—mostly calcium gluconate—are most popular, but Dr. Seiden thinks that properly balanced calcium-phosphorus-magnesium solutions are safer and more economical.

THE term "milk fever" is a misnomer—very rarely does fever accompany this very common, widespread, and serious affliction which is primarily a metabolic disorder occurring in dairy cows and occasionally in ewes. It is known by various names which indicate its most common symptoms, but not all of them; *e.g.*, parturient paralysis, parturient paresis, or parturient hypocalcæmia.[1] Milk fever is often observed a few hours after calving, but may be delayed for a few days or even weeks; it is characterised by depression, collapse, spasms of the neck muscles, inability of the "downer cow" to get up, lowering of all body functions and often also of the body temperature. The Ca (calcium) level of the blood is usually much lower than the normal 10-11 mg %. A Russian investigator recently stated that the following changes can be observed 12-48 hr. before the cow goes down with milk fever: slower rumen movements, faster breathing, lower skin temperature, and higher blood pressure.[2]

In the more complicated cases of the milk-fever syndrome, the condition is more complex than the mentioned symptoms indicate. Often the Ca deficiency is accompanied by P (phosphorus) and Mg (magnesium) deficiencies, particularly if pastures and feed rations are deficient in these elements.[3] For instance, in the north-western parts of the United States the soil and, therefore, the plants grown on it are often low in Mg and P content. If farmers anywhere in the world, even those having rich soil available, do not use fertilisers properly, they too, will grow feedstuffs which are deficient in P and/or Mg and/or Ca; and if such feeds are given to animals over long periods of time, the cows may develop more complicated conditions of the milk-fever syndrome than those occurring in neighbouring areas. This close relationship between soil-plant-animal deficiencies was long overlooked.

Long known, however, is the fact that high-producing and well-nourished animals are more susceptible to this acute affliction than poorly nourished cows. Another interesting observation is that the disease very rarely occurs at the first calving, but is most frequent after the birth of the third to seventh calf; the condition is likely to recur at subsequent calvings in a cow which once had an attack.

The situation can become very complicated since the milk-fever syndrome may consist of any or all of the following conditions: hypocalcæmia, hypophosphatæmia, hypomagnesæmia, and/or hypoglycæmia (*i.e.*, lower than normal blood levels of Ca, P, Mg and/or glucose); hypomagnesæmia, also called grass tetany, is often fatal; it may develop soon after recently freshened cows are turned on a lush pasture.[3] On the other hand, in some rare cases of this syndrome, hypermagnesæmia (high blood-Mg level) may be observed.

It should be emphasised here that a fall in the Ca blood level occurs even in the normal cow at parturition time; it is also a well-known fact that the parathyroid mechanism plays an important role before and during the parturition. Insufficiency of the hormone may be the basic cause of the (secondary) hypocalcæmia. Not all the biochemical and physiological problems involved in the development of the milk-fever syndrome are fully understood at present. It is probable that an increase in the nutritional levels of available mineral elements, and particularly of Ca and P (and vitamin D) during the last 2 or 3 months of pregnancy, is beneficial and that some of the Ca is wasted if sufficient utilisable P is not supplied in the feed.

Treatments for milk fever

Preparations for the treatment of the milk-fever complex are among those produced by veterinary pharmaceutical manufacturers in very large quantities. Before World War I the most common treatment consisted in the inflation of the udder with oxygen or air which (mechanically) distends the mammaries and thus prevents the further interchange of Ca and other elements from the blood to the microscopic acini (sac-like beginnings of the excretory ducts) of the mammary gland; the distention may even reverse the interchange, forcing the Ca (which is heavily concentrated in the gland) back into the blood.

For a few years infusion of potassium iodide solution into the udder was

widely recommended, but a more satisfactory treatment became available with the injection of calcium salts,[5] first calcium chloride (which requires careful handling to avoid sloughing), then calcium gluconate[6] and other calcium compounds. More recently, large doses of vitamin D_2, D_3 or dihydrotachysterol have been given orally or parenterally for the prevention of milk fever, but the results are not always worth the expense. Thus, the parenteral administration of Ca-containing preparations remains the standard treatment of the milk-fever complex.

Because calcium gluconate is soluble in cold water only to the extent of about 3·3% and solutions up to 30% Ca are required by some veterinarians, stabilisers, or crystallisation inhibitors, such as boric acid[7] (using 10 to 30% of the calcium gluconate quantity), aluminium chloride (15%),[8] and calcium hypophosphite[9] have been used in (now expired) patents. Many of these solutions contain also Mg and/or P salts; and dextrose (glucose) is often added[9] to them; these elements and the dextrose are the only blood ingredients which can be lost from the animal's system excessively in the milk of a high-producing cow which, as we know, is in greater danger of becoming afflicted with the milk-fever complex than are poor milkers.[10]

Many milk-fever remedies on the market contain much more Ca, Mg, and/or P than a cow would need if she had lost the total content of these blood elements.

Table 1. Constituents of Milk and Blood in Healthy Cows

	Per cent milk	*Per cent whole blood*	*Ratio Milk : Blood*
Sugar	4·800	0·070	68·6 : 1
Ca	0·144	0·005	28·8 : 1
Mg	0·012	0·002	6·0 : 1
P (total)	0·079	0·018	4·4 : 1
K (potassium)	0·155	0·338	1 : 2·2
Cl (chlorine)	0·103	0·308	1 : 3
Na (sodium)	0·038	0·270	1 : 7·1
Fe (iron)	0·00027	0·038	1 : 144·4

Table 2. Sugar and Mineral Depletion in Lactating Cow

	Daily depletion by output of 3¼ gal. Milk, in Grams	*Total Content in 68 lb. blood of 900 lb. Cow in Grams*	*Ratio Milk : Blood*
Sugar	600·00	21·70	27·7 : 1
Ca	18·00	1·55	11·6 : 1
Mg	1·50	0·62	2·4 : 1
P total	9·88	5·58 (2·36 inorg. P)	1·8 : 1
K	19·38	104·79	1 : 5·4
Cl	12·88	95·48	1 : 7·4
Na	4·75	83·70	1 : 17·6
Fe	0·034	11·78	1 : 346·5

Depletion of sugar and minerals

According to analytical findings,[11] healthy cows show the average composition of milk and blood (expressed in per cent by weight) given in Table 1.

In analysing these figures, we note that the first four ingredients are always present in higher concentration in milk than in blood, which explains why certain deficiencies are manifested almost exclusively in the producing female. If the daily output of milk from a cow weighing 900 lb. (and having 68 lb. of blood) is 12·5 l. = 3¼ gal. (which is not very high), it greatly depletes her reserves of sugar, Ca, P, and Mg and we can understand that even liberal feeding to the extent of a gaining body weight may not arrest these losses, see Table 2.

The milk : whole blood ratios in both tables show very clearly that lactating animals require—in addition to sugar—Ca, Mg, and P. If one of them is missing or insufficient, a surplus of the other elements will be of no value; the cow will not recover or will suffer recurrence of symptoms.

In parturient paresis—the common form of the milk-fever syndrome—the Ca and inorganic P content may drop 50% according to J. W. Hibbs;[12] in grass tetany, Ca may drop as much as 30%, inorganic P 5%, and Mg more than 70%.

Very rarely, if ever, has a practising veterinarian occasion to undertake a complete blood analysis before treating the downer cow; such a blood analysis, no doubt, would be done by physicians treating human beings suspected of an obscure mineral-deficiency disease. Therefore, the simultaneous administration of the three minerals which can be deficient in the cow—Ca, P, and Mg—preferably together with dextrose (glucose), is an insurance policy: it assures the success of the treatment, provided there are no other complicating factors involved in the case; and no harm can be done, even if the animal's disease is simple hypocalcæmia, since the unused portion of the injected mixture of mineral salts will soon be eliminated in the urine.

The old adage, " If a little is good, more should be better " just does not work in medicine—in fact an overdose of Ca may damage the weakened heart of the downer cow.

Basing his calculations on the findings of such authorities as H. H. Dukes and D. L. Coffin, an experienced Vermont practitioner, W. E. Lagrange,[13] declared at a recent conference held at the Ontario Veterinary College that there is much misuse of Ca therapy and that (considering all possible losses) the rational dose for the treatment of parturient paresis of a large dairy cow is 5 to 6 grams of elemental Ca.

Calcium preparations

Most of the "stabilised " calcium gluconate preparations now on the market are too acid and too concentrated to be used by other than intravenous (or intraparenteral) route. For this reason, calcium



Downer cow receiving from vet a subcutaneous injection of a non-irritating (neutral) Ca solution (calcium levulinate) to supplement an already given intravenous injection. A subcutaneous injection takes longer than an intravenous injection to make available Ca ions to Ca-deficient blood, so it is a useful booster.



Intravenous injection of calcium levulinate administered to the left jugular vein. The farmer helps the vet by holding the bottle, the Ca solution running in by gravity. Intravenous injection acts immediately in contrast to subcutaneous injection.

levulinate (Ca content 13·1% against 8·9% of calcium gluconate U.S.P. or 9·3% B.P.) and some other, more water-soluble Ca salts are now being used increasingly. Their aqueous solutions are (almost) neutral and more often diluted, yet as rich in Ca as the old-established calcium gluconate preparations; thus, they lend themselves well to longer-lasting subcutaneous and intramuscular administrations which are often preferred, particularly when a cow is being treated which is known to have relapses.

Among other compounds now being used in parenteral Ca preparations for veterinary use[5] are calcium glucoheptonate, calcium glutamate, calcium glycerophosphate, calcium lactobionate, and calcium *d*-saccharate. Many of these salts act as solubilisers for calcium gluconate and are therefore sometimes used together with it. However, exposure to freezing and shaking (*e.g.*, in transportation) may cause in some of these solutions formations of "seedlings" (minute solid particles) and, thus, the precipitation of calcium gluconate. Stable is a "stabiliser-free" solution containing not more than 3·4% (w/v) calcium gluconate and 5·1% calcium levulinate, which results in a solution equivalent in Ca content to 10% calcium gluconate; the same holds true for a 6·8% calcium levulinate solution free of gluconate.

Preparation of calcium gluconate products

The so widely used calcium gluconate solutions can now be prepared at great savings from glucono deltalactone according to this reaction:

$$2C_6H_{10}O_6 + CaCO_3 + 2H_2O \rightarrow Ca(C_6H_{11}O_7)_2 + H_2O + CO_2$$

A procedure which enables the saving of at least 35% over the present material costs of preparing a 20% solution from calcium gluconate consists in dissolving in a covered tank (which, because of CO_2-foam development, must be filled only partly) 82·8 kg of glucono deltalactone in 300 l. of distilled water. Then 23·3 kg. of calcium carbonate (U.S.P.) is added and vigorously stirred for 10 min. (for foam control). After stirring for another 50 min. and boiling, 14·5 kg. of boric acid (U.S.P.) is added and the solution cooled to 50°C.; 85 kg. or more of dextrose may be added, before the solution is filtered, diluted to 500 l., filled into bottles, and autoclaved at 10 p.s.i. for 30 min.

Finally—to prepare a stable calcium gluconate solution, one should know that the minimum amount of boric acid to be used as solubiliser is 10% of the amount of calcium gluconate to be dissolved; and that a higher percentage ensures stability of the finished product over a prolonged period of time; dextrose (glucose) is often added because of its therapeutic value and also because it prevents precipitation of the Ca salt. A proved procedure is as follows:

Add 90 kg. of calcium gluconate to 300 l. of distilled water, boil for 5 min., add 14·5 kg. (or more) of boric acid, and boil until the solution is clear. Then cool to 50°C., add 75 kg. (or more) of dextrose, filter, dilute to 500 l., fill into bottles, stopper, and autoclave at 10 p.s.i. for 30 minutes.

Phosphate preparations

While Ca therapy for the milk-fever complex is well established, the importance of P for the treatment of this condition is only slowly being recognised. Calcium hypophosphite was first used as stabiliser for calcium gluconate in the U.S.A.;[9] it was soon afterwards, yet seemingly independently, employed in parturient paresis by Prof. W. Hallgren[14,15] in Sweden. He found that in a group of 881 affected cows, 85% responded favourably to intravenous Ca therapy but 77 cases which did not respond even to repeated Ca treatment, were further examined. Of them, 12 could be contributed to normal relapses, but the remaining 65 showed the normal milk-fever symptoms, yet had low serum P instead of low Ca levels; they responded favourably to calcium hypophosphite injections.

A Dutch researcher, A. Osinga[16] observed that due to the stress caused by parturition not only the Ca and P values of the blood serum and the Ca : Mg ratio decrease, but the cholesterol content as well.

In discussions I had with experts in the U.S. and in Europe, I have come to the conclusion that my 23-year-old theory which formed the basis of one of my first American patents, is now being supported by an increasing number of investigators; namely, that there is no advantage in treating the milk-fever complex with highly concentrated solutions—even the most concentrated calcium borogluconate solutions cannot prevent relapses[17]—and that properly balanced, diluted Ca-P-Mg solutions are preferable to them; in addition, they are safer and more economical.

A complete well-balanced Ca-P-Mg-dextrose preparation which is free of foreign-body stabilisers, will soon become available in Germany and France, where know-how contracts were signed by the American firm which introduced this solution first to the veterinary profession.[9]

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THE SCENT OF FLOWERS AND LEAVES *A Search for Fragrance among the Minor Natural Orders*

By Edward S. Maurer, F.L.S., M.R.I.

5. The Snapdragon Family *(Scrophulariaceæ)*

Although the many members of the snapdragon family are generally thought to be scentless, the author has discovered in it many instances of fragrant or malodorous characteristics. Several fragrance patterns emerge which are worth the attention of the perfumer and once again the many malodorous types might provide useful fixatives. In his previous articles Mr. Maurer discussed bindweeds (January), arum lilies (February), primroses and cyclamens (March), and borage (April).

THE snapdragon or fig-wort family is a large and botanically important order comprising herbs, shrubs and, rarely, trees. It extends to some 200 genera and upwards of 2,000 species, inhabiting all parts of the world, from the Arctic to the tropics. The species generally possess acrid and bitter juices; some plants have powerful narcotic and toxic properties. Although many species are cultivated for the beauty of their flowers, the family is generally regarded as being scentless, yet I have come across instances of a fragrant or malodorous proclivity.

On the whole, the family is perhaps the terrain of the medical botanist, and in this connection it is interesting to observe that a dozen or so wild plants still familiar in Great Britain featured largely in the domestic herbals which gradually emerged during the latter part of the sixteenth century and were based upon the early texts of Dioscorides and other writers on herbal lore. (See Bibliography at end of article.)

The common species

We may therefore make a preliminary list of these domestic plants which bear such familiar rustic names as foxglove, snapdragon, toad-flax, fig-wort, speedwell, forget-me-not, eye-bright and mullein, while indigenous to N. America are many species of *Chelone* (salt rheum-weed), *Gratiole* (hedge hyssop) and *Gerrardia* (false foxglove); upwards of a score or more genera are featured in the botanical herbals of that country.

Among the familiar denizens of the northern hemisphere gardens there are some 60 ornamental herbaceous plants of which this catalogue may be reduced to the passing mention of the *Alonsoas*, *Antirrhinums*, *Calceolarias*, *Pentstemons* and *Verbascums*. Among these there is some indication of a pleasant but nondescript scent and also some instances of peculiar malodours.

Etymology

The family derives its name from the Latin *scrofula*, signifying a tuberculous condition of certain lymphatic glands, and because the roots of some species of the fig-worts (L. *ficus* = pile-wort) resemble such formations. The plants were once thought to alleviate these conditions. A form of scrofula known as *struma* was a cushion-like swelling affecting the neck glands and known in bygone times as King's evil, from the belief that a cure would be effected by a touch from the Sovereign. Queen Anne (1665-1714) was the last English monarch to honour this custom. From childhood Dr. Samuel Johnson was afflicted with this complaint.

Some familiar wild plants

Veronica beccabunga: This is the common "blue flower of Saint Veronica," known as brook (or beck) lime from the A.S. *brok* and *bunga* meaning "bunched-up." In several ways it resembles some of the watercresses, and at one time the leaves were used in salads, for when crushed they emit a pleasant, pungent, minty-mustard-like odour. There are upwards of 130 wild and cultivated European, American and tropical veronicas, many of which are listed under the generic name of speedwells from the habit of the corolla in falling off and flying away as soon as the blossoms are gathered, whence the rustic valediction of "speed you well."

The peculiar beauty of the blue flowers of this genus is particularly evidenced in *V. chamædrys*, commonly known as angel's eyes, germander speedwell, blue stars or female fluellin. The flowers are scentless, but the dried foliage has an aromatic fragrance so like that of Indian tea that in some Continental rural districts it is still known as *Thé de la Europe*. *V. cupressoides*, indigenous to New Zealand, is reported to have foliage which, on bruising, has a sweet cedarwood-violet fragrance, and it may perhaps be presumed that in this numerically large genus there should be other folial nuances awaiting record.

Euphrasia: E. officinalis is the common eye-bright. The meaning attached to the Greek *euphranio*, as joy or gladness, may perhaps be construed in favour of the relief given to the eyes as a collyrium, especially after sandstorms. Here also the purity of the cerulean tint of the blossoms calls for comment—Keats knew it thus:

> "The trembling Eyebright showed her sapphire blue."

But in addition to the remedial powers long attached to this unique plant, there is also an allusion to the metaphorical "opening of the eyes," for Milton relates how the Archangel Michael ministered to Adam after the Fall:

" . . . then purged with euphrasine and rue
His visual orbs, for he had much to see."

The freshly expressed juice is saline and slightly styptic to the taste, while the dried foliage has a faint witch hazel-like odour. This suggests that an appropriate dilution of the sap with distilled water would furnish a natural isotonic eye lotion of cosmetic interest.

Scrophularia: S. nodosa, although generally known as the knotted-root fig-wort, is remarkable for the plethora of county names such as the Great Pile-wort, Rosenoble and Throat-wort; the odour of the fresh roots resembles that of Galbanum, but is more narcotic. *S. aquatica* is the water betony or bishop's leaves, also known by the sobriquet of " Stinking Christopher "; the leaves exhale a strong disagreeable dank odour very similar in my opinion to the heavy, rank smell of the dwarf elder. Other interesting species are *S. mellifera*, the Barbary fig-wort, and *S. scorodonia*, the balm-leaved fig-wort; galenical extracts of these are available and of interest to the perfumer as a new approach to fern scents.

Digitalis: D. purpurea is the familiar purple foxglove, dead men's bells, fairy fingers or lusmore, long esteemed (from its digitalis content) as a rapid cardiac stimulant. When bruised the fresh leaves exhale a similar narcotic odour (as above), but on drying a faint woodruff and tea-like fragrance is noticeable. No mention of scent appears for the white, pink or purple " finger-hats," but some of the S. European yellow-flowered species, such as *D. ambigua* and *D. Mariana*, have a primula-like scent.

Mullein: The A.S. *molegn* refers to the scab in cattle, but the genus is listed as *Verbascum Thapsus* (Thapsus, its locality in N. Africa). This is one of those complex botanical names which need dissection in order to glean something about it, for in the first instance it is one of the many examples where, during the passage of time, phonetic alterations have taken place, for originally it was known as *barbascum*, in reference to the shaggy bearded appearance of the leaves, and in time gradually began to be known as " blanket-herb " in some districts and in others as " shepherd's club." The County Floras list the plant by some 30 further sobriquets, and the garden manuals offer a choice of nearly 100 species.

However, the common mullein is found extensively in the hedgerows and woodlands of Southern England, conspicuous therein by its height, frequently 8 ft. and over; a solitary staff, the pale stem rises from a rosette of thick, downy, flannel-like leaves, and towards the tip of these "Jacob's-staff " or " Aaron's-club," the much diminished leaves merge into a dense flower spike, the golden blossoms by simple aqueous extraction yielding a yellow pigment at one time used extensively by country girls as a permanent colour rinse for their tresses.

The peculiar fabric-like foliage is also unpleasantly sub-narcotic-odoured, the fine silky hairs which impart the downy effect are capable of promoting intense cutaneous irritation, similar to that from the well-known *Mucunas* (cow-itch).

Upon drying the freshly-gathered blossoms lose their rankness and reveal the unexpected sweet odour of Florentine iris, a decoction of which figures in most continental recipe books; while for the garden lover of such tall background plants as the Sunflowers and Hollyhocks there are many species of Verbascum to complement.

Linaria: The flax-like *L. vulgaris* is the common toad-flax of the wayside, and it has a number of country names, such as " Butter and Eggs," from its yellow- and orange-coloured blossoms. The garden manuals offer upwards of 100 ornamental species, but among these the only reference I have come across regarding a scented proclivity is in the N.E. Arabian floras, where *L. odorata*, *L. micrantha* and *L. simplex* are reported upon as having a sweet woodruff-like odour.

Russelia (after D. R. Russell): There are some half a dozen red-flowered Mexican species, of which *R. equisetiformis* bears foliage furnished with large aromatic resinous glands and would therefore appear to merit investigation, as would also the dank-odoured N. American *Leptandra virginica*, the Black, Culver's or Physic root.

Pedicularis: This genus is allied to the *Melampyrums* and the *Gratiolas*, and in view of the vermin-deterrent properties found among the upwards of 40 N. American and E. Asian species, we may perhaps anticipate something of a strong, resinous, tansy odour, as also among some of the allied plants incidental to Madeira, such as the *Subthorpias* and the viscid-leaved *Bartsias*.

Gratiola: Named from the Greek word for graceful form, there are upwards of a dozen of these blue- and yellow-flowered N. American " Hedge-hyssops," a genus allied to the *Mimulus*. The foliage immediately after bruising is remarked as being pleasantly herbal, but after drying has an odour something like the olidness of stale horse manure.

The fragrant fig-worts

Celsia (after N. Celsius): There are about a dozen species of this West Asian genus, of which *C. Cretica*, the Cretan mullein, is typical. It has maroon-centred yellow flowers which exhale a fruity genista-like fragrance.

Angelonia (Brazilian for " little angel ") is allied to the *Alonsoas* and *Nemesias*. *A. grandiflora* is the best of some half a dozen S. American species bearing large spikes of royal blue blossoms which are reported to have a scent very like that of freshly-sliced pineapple.

Lyperia: The Greek word *lyperos* means sad or dismal and well describes the unattractive drab blossoms of this genus, of which *L. crocea* is the S. African " Saffron." This, like *L. tristis* and *L. fragrans*, has towards evening a sweet-william-like scent which is also a feature of some of the allied *Manuleas*.

Nycterina: The Greek word *nycteros signifies* " by night," and here we come across further examples of evening fragrance. The pure white *N. capensis* and the orange-centred white *N. selaginoides* are indigenous to S. Africa.

Judging from a list which I have made of the various types of scent to be found among the night-scented plants, I should describe the nuance of the *Nycterinas* as a spicy almond, but some species are catalogued under *Zuluzanskaya*, the lilac-coloured *Z. villosa* being known in S. Africa as the night-blooming phlox.

Nemesia: Named from the Greek goddess of justice, there are about half a dozen of these S. African annuals (allied to the *Hemimeris*) bearing a mass of blooms " all colours of the rainbow," the most interesting being *N. floribunda*, the yellow-throated blossoms of which also have a clove-like scent.

Hebenstreitia (after M. Hemenstreit, a famous Dutch botanist): Of the several species, *H. dentata* is described in a Kenya flora as being " a charm-

ing bushy-looking plant with very small leaves and tiny orange-lipped flowers looking somewhat like a white reseda. The blossoms are waxy and the scent resembles that of the mignonette." Here, as well as in the next item, we find an alternative to the spicy-clove nuance.

Limno/phila: There are a number of these marsh-loving E. Indian aquatics, of which *L. gratioloides* exhibits a very peculiar but nevertheless a very refreshing odour calling to mind a liaison of camphor and fresh lemons.

Mazus: The Greek word *mazus* refers to the tubercules in the mouth of the blossom. *M. radicans* is the New Zealand "teat-flower," the white blossoms of which have a honey-like fragrance; this is also observed in the related *Dodartia* from the same locality.

Chæno/stomas (signifying gaping-mouth, in reference to the wide bottom part of the flowers): This is indigenous to S. Africa, where it is known as the white wallflower from the similarity of the scent; oddly enough, *C. fætida* from the same area is described in the local floras as having "a really nasty smell."

Er/inus: Er, a Greek prefix denoting springtime, refers to the very early appearance of these blossoms. The magenta-coloured *E. alpinus* and the yellow blossoms of *E. fragrans* are described as having a "delicate, faintly spicy and very sweet scent."

Mimulus: Commonly known as the Monkey-flower, for in Latin *mimus* means an ape, in reference to the ringent or gaping mouth of the flower, which has some semblance to a monkey's face. The present strains of *M. moschata*, the garden musk-plant, no longer possess the one-time delicate musk-like fragrance, an oddity which was considered at length by the writer in an article upon the musk mallows which appeared in the September 1957 issue of *Soap, Perfumery and Cosmetics*. It should be noted, however, that there are upwards of 40 species in their native S. America; many of these are similar to the Californian *M. moniliformis*, which exhales a strong, resinous, aromatic and balsamic odour—a description which applies to the fragrance of the vegetal musks—and in my opinion it would seem very likely that a detailed study of some of the wild Mexican species would reveal something of a close fragrance which could take the place of the lamented musk flower.

Paulownia: Named after Paulowna, daughter of a Russian Emperor, *P. imperialis* is an ornamental Japanese tree—one of the few in this family—growing to 30 ft. in height and bearing spotted violet foxglove-like blossoms which disseminate a fragrance noted as a liaison between methyl eugenol and geraniol, which towards evening can be distinguished at a considerable distance.

Conclusions

This is a very prolific family. What I have described is less than a tithe of the Central South American and S. African genera. Beyond this the data are meagre, but from the notes I have made I would predict that at some time a study of the *Vandelias*, *Castillejas* and *Limosellas* will afford the perfumer a new concept of orchidaceous nuances.

Summary

In this search for fragrance among the Minor Natural Orders this family has been chosen for examination because from a cursory survey it was evident that it contained no items of perfumery commerce, consequently this essay is an exploratory review in which sundry fragrance patterns emerge which (in these articles) have already been noted as common to other families. Once again, several malodorous types appear which are of potential interest as fixatives, but it would seem that the odours of the flowers, and roots of some of the many verbascums should prove worthy of further attention.

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The Active Principles of Plants in Cosmetology, H. Janistyn, *American Perfumer*, January 1961.

PROTECTING CROPS FROM OZONE DAMAGE

Crop damage from excessive atmospheric ozone is becoming a serious problem in the United States. Stipple of grape in California and weather fleck of tobacco in Connecticut are two examples of ozone damage. Rich and Taylor of the Connecticut Agricultural Experimental Station, New Haven, report in *Science* (1960, **132,** 150) that manganous 1,2-naphthoquinone-2-oxime protected tomato foliage in the field from damage apparently caused by excessive ozone. The compound proved to be a very effective antiozonant. The similar cobaltous and manganous chelates of 8-quinolinol were also effective antiozonants. The materials were applied to cloth of the type used to make field tents for shade-grown tobacco. Tomato plants covered with cloth treated with cobaltous 8-quinolinolate were protected against otherwise damaging concentrations of ozone.

COSMETIC ALCOHOL

The need for some of the horrible denaturants used in bygone years is gone and it is a shackle on the neck of the (alcohol) industry. Take industrial methyl alcohol. First, it stinks to high heaven; then the stuff is toxic, whether applied externally or taken internally. And yet, in this day of enlightenment, the United Kingdom and a number of countries of the British Commonwealth still use such a denaturant for alcohol intended for cosmetic use.—M. G. de Navarre, *American Perfumer*, Feb. 1961.

POETRY AT THE CHRISTENING

How lacking in poetry are the names of modern drugs. What vendor, crying his wares, could get any emotion into, "Who'll buy my Methyl-1 : 1-itsy-bitsy-pheny-bikinilamide hydrochloride!", be it ever so dextro-rotatory, and anyway if you want to prescribe a drug it's a help to be able to spell it. Emil Fischer solved the problem when he named his discovery "Veronal," after the town of Verona where his train broke down. With British Railways to help, our choice could become embarrassingly large. Electric computers have been used to "synthesise" new names, but it will be some time before they come up with anything to rival the "Elixir Grandior, or Aurum Potabile of the Ancients, and Sovereign Restorative for Health and Long Life," as prepared from "the Elixirated Fountain of Sanative Virtue," by Jasper the Hermit, who would not have recognised a benzene ring if you had hung it round his neck. It was therefore refreshing to be asked recently by a patient for "some of them capsules of tranquillity."—*A Peripatetic Correspondent in "The Lancet."*

Process Cooling Plant and Equipment

Flake Cooling ★ Cooling Jackets ★ Vibratory Feeders ★ Freeze Drying
Spray Cooling ★ Small Cooling Towers ★ Chlorofluorocarbon Refrigerants

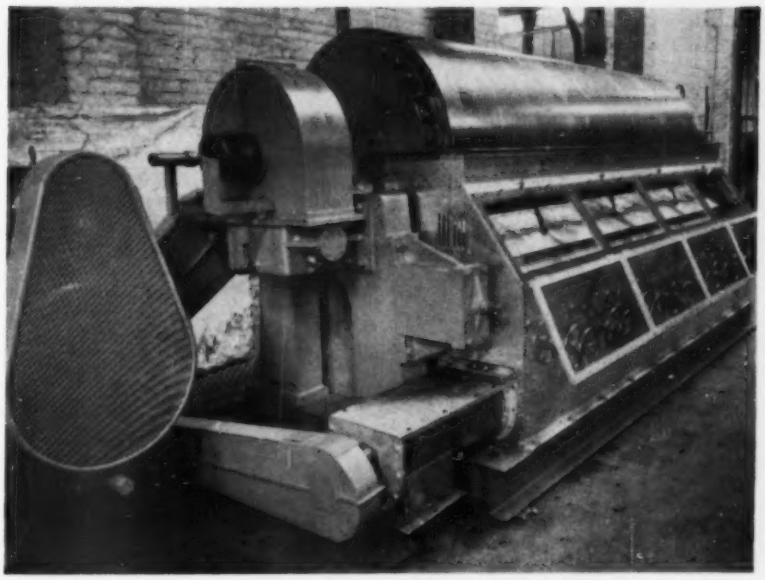
Flake Cooling Machine

WAXES, caustic soda, phthalic anhydride, naphthalene, sulphur and other chemical products can be cooled efficiently by the flaking drum process.

The molten material to be cooled is fed into a trough from which it is picked up by a revolving drum cooled by internal pipes which spray the upper part of the drum surface. In this way the product is cooled into a thin film as the drum rotates.

The solid product is scraped off the drum as small flakes by adjustable doctor knives and delivered to a worm conveyor inside the enclosure or casing. The speed of the drum can be adjusted to suit the period of cooling required by different products. The system provides a high rate of heat transfer. Cooling water is removed from the drum by a steam operated ejector pump.

L. A. Mitchell Ltd. make a flaking-cooling machine fitted with a close-grained iron cooling drum 4 ft. diameter by 11 ft. long.



Mitchell flaking drum machine supplied to I.C.I. for the production of chemicals in flaked form. The drum is 4 ft. diameter by 11 ft. long.

Spiral Tube Cooling Jackets

Several advantages are claimed by Metal Propellers Ltd. for their spiral tube jackets for cooling reaction vessels. The positive directional heat flow path gives a more consistent temperature distribution than is possible with an open jacket.

The input of cooling medium can be further increased if separate spirals are employed similar to a double or triple start thread, each with its own stem or fluid connection.

Skin stress characteristics permit considerable reduction in inner shell thickness—about 50% for nominal working pressures. Usually the half-round section tube is 3 in. diameter ×12G wall thickness. Welding quality stainless steel is used to ensure minimum erosion and corrosion and permits a high efficiency weld between tube and vessel wall which provides high resistance to thermal shock.

Cooling Granular and Powdered Materials

Magnetic vibratory feeders and conveyors made by Magco Ltd. can be employed in cooling granular and powdered materials. These electromagnetic vibratory units give a constant rate of feed. Another advantage is that there are no wearing parts requiring lubrication.

Specially jacketed feed trays through which cold water is passed are normally used. Cold air can also be used or special refrigerants, but of course these are more expensive. Normally for efficient cooling the depth of material should only be one granule thick. This can be accomplished by using a metered hopper feeding on to the cooling tray. The trays are made in various materials and sizes. Stainless steel is most common, especially for the pharmaceutical industry. The normal length tray is 10 ft., but conveyors can be adapted for virtually unlimited lengths. For certain special cooling applications a cascade type of tray is fitted so that a tumbling action is transmitted to the material to be cooled.

Freeze Drying

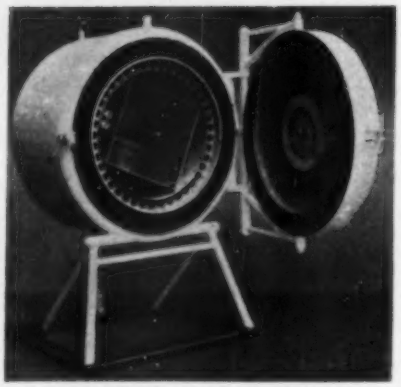
Pharmaceutical products whose biological activity is to be preserved are frequently processed by freeze drying in small sterile containers. The rate of pre-freezing must be rapid, in order that complete freezing may take place at a particular temperature level. The surface from which the vapour of sublimation has later to escape must be as large as possible. Such material is often frozen to the inside of thin ampoules or flasks in an even layer by "shell freezing." In this method, vessels lie almost horizontally and are rotated while being chilled, so that the liquid contents wet the inside evenly. This thin layer freezes and is gradually built up into a shell.

Leybold-Elliott have a range of pre-freezers for such duty. The one illustrated is an air-blast freezer. The ampoules or flasks are housed in a basket which is placed in the machine, and rotated by a geared drive. Around the carrier the evaporator coils of a cooling machine are arranged. There is a fan mounted in the door to circulate chilled air up through the bank of vessels and

down past the coils. Rotation is gentle, so that the material is not physically damaged by centripetal forces; nor is there the same tendency for initial crystal formations to break off and build into a loose ball of ice. Drying from the liquid phase, resulting in denaturation, is avoided in the method.

Any desired freezing rate to specified temperature levels can be provided by an appropriate refrigerant.

Other types of process coolers, *e.g.* continuous air-blast conveyor-tunnels and chilled-shelf batch-cabinets, are available, the latter enabling freezing and drying to be carried out in the one unit.



Leybold-Elliott air-blast pre-freezer for pharmaceuticals.

Recooling Process Water by Spraying

For high cooling efficiency a spray nozzle system must bring into intimate contact the largest possible surface area of water droplets with the largest possible volume of moving air.

Piping and nozzles must be arranged to ensure good circulation of air through the sprays. Large narrow systems with wide air lanes provide proper circulation without excessive loss of spray through drift. Nozzles should be 3 to 4 ft. above the water in the pond.

Nozzles selected should be of the type and size to produce the high fine sprays required for satisfactory cooling, at operating pressures low enough to keep pumping power at a minimum. Most spray systems are designed for a pressure of 7 lb. at the nozzle.

Ledward and Beckett Ltd. offer spray nozzle systems to these specifications. Their spray ponds are arranged to make the best possible use of ground or roof space. Piping systems are designed for easy installation and proper distribution of sprayed water. Their involute spray nozzles are claimed to give a fine spray and efficient cooling at low operating pressure.

These nozzles have no internal parts such as vanes and deflector plates on which foreign particles can collect. The contour of the body guides the flow in an involute path, deflecting it gradually and with little loss of energy towards the orifice. The outlet is located so that the liquid obtains maximum velocity at the rim of the orifice and the discharge leaves the nozzle in a finely divided cone-shaped spray.

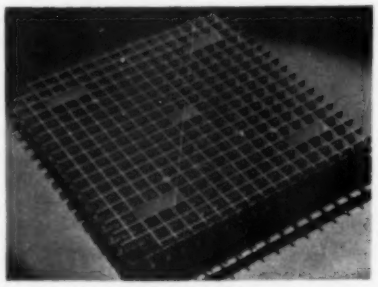
There are two types of nozzle in six different sizes which have different capacities and spray angle characteristics. They are made in gunmetal but are also available in cast iron and other metals.

The nozzles are usually arranged in clusters of five attached to horizontal radial pipes and spray upwards. The radial pipes are connected to the main piping by cast iron flanged distributor heads. They are made parallel and taper in sizes from 4 in. to 16 in. with flanges drilled to customers' requirements. All heads are flat on the underside to permit uniform height of pipe supporting piers and to ensure complete drainage of the system through a drain nozzle fitted to the end of each branch main.

Small Cooling Towers

Head Wrightson Processes Ltd. recently introduced a new series of small cooling towers specially designed to handle refrigeration and small process cooling requirements—these are their Series I towers.

The towers are 3 ft. 10 in. square and 8 ft. or 10 ft. high, packed with *Polygrid* packing which is basically



Polygrid packing grid moulded to measure 3 ft. by 3 ft. incorporating ¾ in. splash strips.

an "egg crate" grid with horizontal splash strips at the top of each rib. The grids are injection moulded from high impact polystyrene and high density polyethylene and the combination of film and splash cooling obtained makes the towers highly efficient.

The shell is heavily galvanised mild steel and is made in three sections; the top section housing the fan motor unit, low pressure enclosed distribution system and drift eliminators; the centre section is formed of flanged sheets bolted together with rubber gaskets and contains the packing; the bottom section is a 100 gal. capacity basin and is complete with water outlet, overflow and make-up controlled by a ball float valve.

Complete prefabrication and simple design make the towers easy to erect. The heaviest part is only 250 lb. and can be handled by two men. The only foundation normally required is a 4 ft. × 4 ft. flat plinth.

Greater heat loads may be handled by using two or more units placed in line some 3 ft. apart or with the now established Series III towers. These larger towers from 8 ft. × 8 ft. to 20 ft. × 20 ft. have also been designed specifically for small plant users with particular attention being paid to keep the overall height and pumping head to a minimum.

The low head Series III towers have a timber framing and top deck and the outer panelling is of corrugated asbestos cement. The basin would normally be of concrete, but a special timber design is available if required.

Light Weight, Glass Fibre Cooling Tower

A complete packaged cooling tower small enough to be transported in a light lorry and manhandled into position on site without the use of large cranes has been developed by Film Cooling Towers (1925) Ltd. The tower, which is supplied complete with tank and pump, if required, is made of resin bonded glass fibre, a construction which, while contributing to lightness, eliminates protective painting.

Water distribution is by a main trough from which the water is discharged through Pyrex brand glass or nylon A.100.M orifice tubes into weir-type spreader troughs. The spreader troughs run the entire length or breadth of the tower at a pitch of 6 in. Each trough wall is

staggered so that the water is discharged throughout the plan area of packing at 2 in. intervals. Therefore a controlled distribution point occurs for every 6 sq. in. of distribution area. The film of water which descends from the walls of the spreader troughs is collected on the nodes formed on the bottom of these troughs and coincides with the pitch of the grid packing.

The timber *Film Flow* serrated grid packing is composed of a number of horizontal trays of parallel laths, the direction of the laths in each tray being at right angles to the trays immediately above and below it. Each tray of laths is only 2 in. deep, and by tracing the flow of water it may be seen that the *Film Flow* changes direction through 90° every 2 in. of total packed depth, thus new surfaces are continuously exposed to the rising airstream.

This method of irrigation ensures an entire and evenly wetted surface which results in the packing having an exceptionally high heat exchange coefficient.

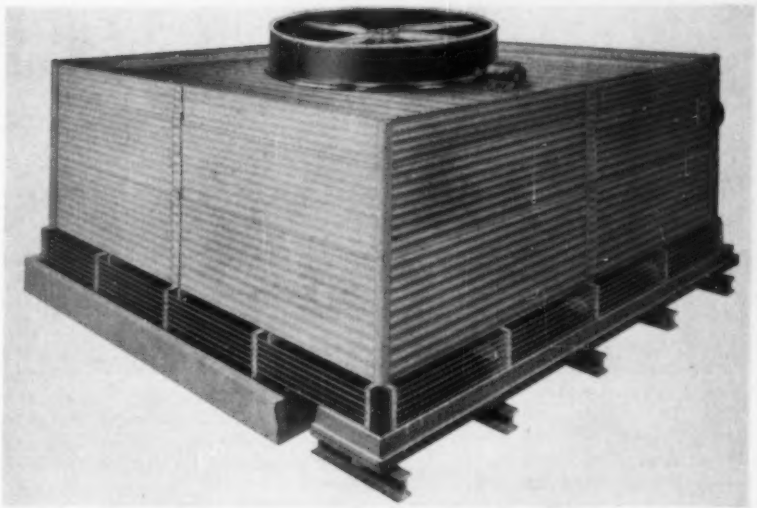
The internal packing and distribution system is constructed of impregnated timber and is proof against all known forms of wet, dry and soft rot organisms or termite attack. The tower is supplied ready for immediate operation, merely requiring the pipework to be coupled after the ground has been suitably levelled. Since the pond is an integral part of the tower, no foundation preparations are generally necessary. If no level floor exists, a flat concrete plinth is all that is required. Provision is made for anchor bolts, for use when the tower is to be installed on a roof or in any location where high wind forces prevail.

The packaged cooling tower can be supplied in an attractive range of self colours to match existing plant and, therefore, requires no periodic painting, thus reducing maintenance costs to a minimum.

Capacities range from 300 to 5,000 gal. of water per hr.

Where cost is, and appearance is not, of paramount importance the fully impregnated timber grid packed tower is offered as an alternative to the glass fibre shell tower.

All structural members of these towers are fabricated from Douglas fir or Baltic redwood, and treated under vacuum and pressure with a wood preservative to ensure long life and immunity from fungal and insect attack.



Series 3 low head cooling tower made by Head Wrightson Processes Ltd.

The film grid packing and water distribution system are identical to those previously described.

All bolts, nails and holding down brackets are heavily spelter galvanised or Sherardised, and timber connectors are used on all structural joints.

The tower can be supplied complete with a mild steel tank, or alternatively mounted on a reinforced concrete basin or in any existing tank.

Capacities range from 300 to 24,000 gal./hr.

Refrigerants

Chlorofluorocarbon refrigerants can be used for duties ranging from large-scale air conditioning to producing temperatures below −200°F.

They have high thermal and chemical stability and can be used in contact with steel, tin, aluminium, brass, copper, lead and many plastics. At ordinary temperatures they are non-flammable; their vapours are non-irritant and non-toxic. *Isceon* refrigerants are obtainable from The Consolidated Zinc Corporation.

Industry's Publications

Tablet and capsule identification. About 150 new products have been included in the latest edition of The Chemist and Druggist Tablet and Capsule Identification Guide, which now provides an invaluable signpost to the identification of more than 900 tablets and capsules, and includes a key to manufacturers.

First published in 1956, the guide has been twice brought up to date with supplementary charts, and is now issued as a set of eight charts, five in colour and two in black and white. The guide may be obtained in two forms—mounted on cards that are eyeleted and corded for hanging, with a washable, laminated surface; or as a brochure on white art paper containing the same illustrations and information. In the coloured charts every tablet is shown actual size and it is relatively simple to identify the tablet or capsule.

Hydrogen peroxide data. A data manual on hydrogen peroxide recently issued by Laporte Chemicals Ltd., is the first publication of this type on its subject to be produced by a British company.

The manual, which is attractively presented in a durable, loose leaf, spirally bound form, is intended for direct reference on the laboratory or workshop bench. Although primarily of interest to engineers and designers in the aircraft and allied industries, the manual covers the major properties of this chemical and will find application over a much wider field than that for which it was intended. It contains physical and chemical data on hydrogen peroxide in graphical and tabular form and includes information on materials of construction, storage and handling, and a copiously illustrated section on suitable equipment for use with hydrogen peroxide.

Training General Practitioners in Chemistry

STRONG INDUSTRIAL LINKS OF NEW CHEMISTRY BUILDING AT SWANSEA

A NEW £615,000 Chemistry Building has been opened at the University College of Swansea. It is part of the £1 1 million development programme of the College towards which the College is expected to contribute £500,000. So far £375,000 has been raised by public appeal.

The Department of Chemistry at Swansea was established 41 years ago. Its courses are designed to produce general practitioners in chemistry. The teaching and research programme is modelled upon the industrial activities and technological needs of the surrounding area. Industry has supported its work generously. Among the firms that have made grants during the past three years are Parke Davis, Roche Products and I.C.I. Funds for apparatus and materials have been granted by Albright and Wilson, British Nylon Spinners, Distillers Co., British Petroleum, Unilever and Mond Nickel. The D.S.I.R., the Institute of Petroleum, the M.R.C., the Royal Society and "Shell" Research have also given help generously.

The growth of the Department of Chemistry has hitherto been restricted by the modest semi-permanent buildings in which it has been housed since 1923. Despite the limited facilities, the Department has carried out valuable research in many fields, but notably, under Prof. C. W. Shoppee, in chemistry relating to hormones and, encouraged and aided by the industries concerned, in pharmaceuticals and medicines.

Prof. C. H. Hassall, whose appointment to the chair of chemistry in early 1957 coincided with the rapid expansion policy of the College, has been intimately connected with the planning of the new building and the design of courses to meet the new requirements for both teaching and research in the growing College.

In addition to providing for the anticipated growth in the number of students reading for Honours in chemistry and later pursuing research, the new building will cater for the greatly increased numbers of science students who will be reading chemistry as part of their degree studies. By the late sixties it is expected that about 2,000 students will be reading pure or applied sciences at Swansea.

Design and construction

The new Chemistry Building consists of three major units: a wing each for teaching and research laboratories linked together into an integral unit by a central spine accommodating lecture theatres, main stores and central services. Accommodation is provided on three floors in each wing. On the roof of the research wing provision has been made for a small laboratory to deal with hazardous experiments.

The building is faced with buff Leicestershire brick and the research laboratories on the first and second floors on the south elevation are enclosed by a pressed metal curtain wall.

Two of the three lecture theatres are stepped, windowless and mechanically ventilated, the larger theatre seating 295 students and the smaller 105 students. The most advanced acoustic practice has been adopted and the lighting, projector, screen and other lecture aids are all centrally controlled at the lecturer's desk.

The latest techniques in laboratory planning have been employed throughout. Each laboratory has been individually designed and equipped for its specific purpose, the whole conception being based on functional considerations.

The novel layout of services within the building has already been the subject of special study by architects concerned with laboratory design on account of its outstandingly functional qualities.

Research programme

Among the comprehensive research facilities installed in the new building is the only equipment in a British university for biosynthesis using chemical genetic techniques or, in layman's language, the study by these methods of the chemistry of life processes. Almost as rare are the special facilities at Swansea for Raman spectroscopy research.

Current interests include vibrational Raman intensities; the study of complex formation; the structure of inorganic and organic cyanides, and studies of fluorine compounds. In collaboration with the Mathematics Division of the National Physical Laboratory a special computer programme for the rapid calculation of force constants from vibrational frequencies has been developed. This is now being used to study changes in force constants in families of molecules. Another group working with Dr. H. E. Hallam is using infra-red spectroscopy for the study of molecular interactions of amides and environmental effects on group frequencies with special reference to solvent effects. Mr. R. H. Davies is working on the electrochemistry of non-aqueous solvents.



An automatic Craig countercurrent apparatus in use for the separation and purification of natural products.

Two groups are involved in the study of rates of reaction. Work on the kinetics of aromatic substitution and the nitrosation of amides and of hydroxylamine is being supervised by Dr. G. Stedman. Isotopic studies which are involved in this work are being carried out in collaboration with the University College of London. The quantitative kinetics of peptide hydrolysis is being studied by a group supervised by Dr. D. A. Long. A special feature of this investigation is the recent construction of an apparatus for automatic chromatography which makes possible the rapid quantitative analysis of micromolar quantities of mixtures of amino acids and peptides; carbon 14 techniques are also being used.

The latter work on peptides is related to the interests of a group of organic chemists working with Prof.



Apparatus constructed in the department for the automatic chromatographic analysis of amino acids and peptides.



The new chemistry building of the University of Swansea opened in May 1961.

C. H. Hassall and Dr. J. A. Schofield. This team is engaged in the development of new chemical methods for the specific cleavage of peptides. Another group with Prof. Hassall and Dr. R. F. Curtis is investigating the structure of natural products and is concerned with aspects of small-ring hydrocarbon chemistry. The major study in organic chemistry deals with the investigation of the pathways of biosynthesis of complex phenolic compounds. The work, which is under the overall direction of Professor Hassall, involves the joint efforts of organic chemists (Dr. R. F. Curtis and collaborators) and microbiologists (Mr. K. Lawrence and Mr. J. D. Lévi). This programme of research, which combines chemical techniques with others drawn from the relatively young field of chemical genetics, has been made possible by a generous grant from the Nuffield Foundation.

Dr. G. H. R. Summers is directing work in the field of steroid chemistry with particular emphasis on reaction mechanism and the application of physical methods.

The completion of the new laboratories has made possible the development of a number of general facilities which are important in the expanding research and teaching programmes. A radiochemistry laboratory has been established by Dr. K. J. Gallagher. The special facilities of this laboratory will contribute to his investigations on hydrogen bonded systems and the chemistry of the solid state. There are facilities for routine spectroscopy. A new microanalytical laboratory will provide for the routine analysis of organic compounds. The semi-technical laboratory and its associated special-facility rooms described in the account of the new building make possible the expanding interest of the department in research into microbial genetics.

The Mechanism of Detergency

The difficulty of simulating soil in the laboratory for detergent studies was mentioned by Dr. D. G. Stevenson in a lecture on the mechanism of detergency at the Royal Society of Arts, London. He was addressing the Society of Cosmetic Chemists and was introduced by the President, Dr. H. W. Hibbot. Giving a typical analysis of soil obtained by solvent extraction of fabrics, Dr. Stevenson illustrated the difficulties of analysis, especially the determination of particulate soil such as carbon.

Continuing, he described the wetting out process, so important in detergency, as the replacement of an air/solid interface by a solid/liquid interface. He gave equations relating the respective interfacial tensions and the contact angle at the air, solid, liquid junction. In 1937 Adam proposed a theory that the displacement of oil from a solid surface by a solution of a surface-active agent was due to a similar mechanism to that of the displacement of the air solid interface in the wetting out process. This however requires that the soil shall be liquid, and was demonstrated by soiling fabric with paraffin wax and noting the ease of soil removal in relation to the temperature of the washing solution. In addition, the nature of the solid, the polarity of the soiling material and their influence on the contact angle would affect the ease of soil removal. This was instanced by the difficulty in removing mineral oils from wool.

Solubilisation

The next point considered by Dr. Stevenson was that of solubilisation in relation to detergency. Molecules of surface-active agents group themselves together in micelles when present in solution above a certain concentration. These micelles can take organic compounds into solution within the micelle in the case of relatively non-polar compounds or in the case of materials with relatively strongly polar groups; they mingle with those of the surface-active agent and are orientated in a similar manner. Detergency commences at concentrations of surface-active agents below the critical micelle concentration, so it appears that solubilisation is not of great importance in detergency.

More recently emphasis has been placed on the influence of complex formation. The presence of free fatty acid with soap or a fatty alcohol with sodium lauryl sulphate, for example, gives lower interfacial tensions than would be obtained with any of the components used by themselves. Detergent solution is able to penetrate between the parallel rows of alcohol or fatty glyceride molecules in the solid state. When

(Continued on page 278)

DETERGENTS and Surface Active Agents

By Leon Raphael, M.SC., F.R.I.C.

Soap-syndet pattern · Japanese plans · European production · Canadian market · Raw materials · Anionic-cationic mixtures · Self-emulsifiable oils · Micelles · Stability of emulsions · High foam surfactants · Sulphated ethers · Sucrose esters

Soap-synthetics market

THE consumption of soaps and detergents in the United States has remained static at around 25 to 28 lb. p.a. per head, over the past 20 years. The developments and changes in the pattern of the detergent market have accelerated since the war, but have now settled down to an almost fixed ratio of syndets to soap of 3 : 1. Soap was made by virtually the same process from ancient times until the present century. The sulphonated oils made an entry into the industrial field and even today 50% of active syndets are so used. The household detergent market was unaffected until about 1930, when light-duty detergents were introduced, their production rising to today's figure of 500 million lb. p.a. While such products were excellent for wool, silk and other delicate fabrics, the harder wearing cottons requiring more drastic treatment had to await the entry of heavy-duty products about 1940. These latter now represent four times that of light-duty detergents and half the total soap and detergents tonnage.

Light-duty products contain about 30% active ingredient built with neutral salts such as sodium sulphate.[1] The heavy duty solids are 20% active, built with 30% tripolyphosphate and containing various additives such as sodium silicate as a corrosion inhibitor, carboxymethylcellulose to prevent soil redeposition and fluorescent dyes, the optical brighteners. Light-duty liquids were mainly based on nonionics, but now heavy-duty liquids are increasingly used containing alkyl aryl sulphonate with tetrapotassium pyrophosphate $K_4P_2O_7$, which is more soluble than the sodium salt, and a coupling agent such as an alcohol to maintain stability.

The changeover from soap to syndets has put an end to price fluctuations of tallow. The surplus, due to reduced soap production, is now used in animal feeding-stuffs. The petrochemicals industry has had only a small gain from the increased use of detergents as their other products far outweigh the raw materials required for syndet manufacture. The phosphorus industry, however, has expanded enormously, the tonnage of phosphorus compounds being more than doubled in the past ten years; 75% of the 1,300 million lb. produced each year in the U.S. are used in detergent compounds.

Sales of synthetic detergents in the United States increased again in 1960 by 4·5% on the previous year and now comprise 76% of the total soap and detergent market. While total soap sales dropped 1·1%, toilet soap sales rose 2·2%. Half the solid soaps in the United States are toilet soaps. The greatest increase in syndets was again shown in liquid products which rose 14%.[2]

Syndets in Japan

The naturally soft water of Japan has restricted demand for syndets in household detergents. However, there is a growing increase in industrial consumption of syndets. A joint American-Japanese company has started erection of a detergent alkylate plant at Kawasaki with a capacity of 1,500 tons p.a. A nonyl phenol plant is due to come on stream with a capacity of 1,200 tons a year.[3]

European production

No great expansion in detergent production is planned in Europe. In Spain it is proposed to produce alkyl aryl sulphonates, sulphonated fatty alcohols and acids totalling 6,000 tons p.a. Italy and Switzerland show little change in consumer habits, although soaps are gradually being displaced by syndets. Switzerland's total market of 65,000 tons p.a. showed a 4% increase in 1959 over the preceding year. Syndets increased their share of the market from 24 to 26%. Italy has a consumption of 300,000 tons a year (15 lb. per capita) of which one-third are syndets. The new Palmolive company will increase production of soaps.

Britain leading exporter

Britain is the leading exporter of soaps and detergents in Europe. In 1959 nearly half the total exports of O.E.E.C. countries, amounting to 200,000 tons, were of British origin. The distribution of these tonnages was almost equally divided between soaps and detergents. France was the second largest exporter of soaps with 40,000 tons; its syndets were less than half this figure. The imports of Britain and France were negligible, but other west European countries imported 40,000 tons of syndets and 15,000 tons of soaps, of which 60% was of European origin.[7]

The Canadian market

Canada has shown the same trend in changing from soap to syndets, and production of detergent alkylate started there in 1957 utilising American know-how for high quality.[2]

Table 1. Canadian Detergent Consumption

(million lb.)

	soap	*syndets*	% *syndets of total*
1950 ..	230	50	17
1955 ..	150	150	50
1960 ..	100	230	70

Production of alkylate in the U.S. has risen rapidly with a corresponding fall in price.

Table 2. U.S. Production of Alkylate

	Prodn. m.lb.	*Price c/lb.*
1948 ..	80	20
1950 ..	180	15
1955 ..	320	12
1960 ..	400	11·5

Raw materials

α-Sulphonated fatty acids, particularly palmitates and stearates, are now commercially available. Their salts are utilised in dry cleaning soaps. The amphoteric surfactants made by the nitrile reaction of a fatty acid and ammonia are another addition to the syndet raw materials.

Improvements in the quality of detergent alkylate have resulted in narrower boiling range, colour stability, and improved colour of the sulphonate, with reduced odour and unsulphonated matter. The average molecular weight of the alkylate corresponds to dodecyl benzene, although there is a distribution due to polymerisation of the propylene. By narrowing the boiling range it has been found that optimum detergency of the sulphonate occurs with alkylate of molecular weight 260 to 270, boiling range 280°-315°C. A comparison of materials of different molecular weight alkylate shows that the addition of lauric diethanolamide (LDEA) gives better foam stability with a product made from molecular weight 268 than with one of m.wt. 248. The influence of the LDEA falls off with increasing concentration of the sulphonate.

Anionic-cationic mixtures

It is generally accepted that mixtures of anionics and cationics are mutually incompatible in solution, forming inactive wax-like precipitates. Clear solutions can be produced, however, when the cationic is less than 25% of the anionic.[4] For example, 20 parts of a 4% solution of *Hyamine* 1622 (a quaternary ammonium salt) mixed with 80 parts of a 4% solution of the potassium soap of coconut oil acids forms a clear solution. Quaternaries of low molecular weight are more compatible with soaps of high molecular weight. The solutions are not always clear, but the precipitates, if formed, are finely dispersed and such mixtures act as excellent lime soap dispersants. Coconut oil soaps require 10% quaternary salts to prevent scum formation in hard water, while tallow fatty acid soaps require 20% cationic. These mixtures foam better than the original soap in hard water, but with a high tallow soap concentration the cationic reduces foam. By using a higher proportion of coconut oil soaps this interference can be avoided.

Cationics lose their bactericidal power when mixed with anionic synthetic detergents and the detergent efficiency of the latter is reduced. By adding a nonionic as a third component, generally the alkyl phenol ether type, mutual solubility is effected. The synergism of the anionic and nonionic is apparent and the germicidal activity of the cationic remains. The nonionic must form at least 10% of the total mixture.

Mixtures of equal parts of anionic and cationic are oil-soluble and dispersible in hot water. They find application in cosmetic preparations. The electro-neutral salts produced are useful in hair-colours. Dye preparations of this type wash out of the hair more readily than the usual dye creams. The mixtures are also used as thickeners for ammonium thioglycollate solutions used in permanent waving creams. By reaction in the oil phase to form neutral salts with slight excess of one surfactant, a stable emulsion is produced when poured into water.[5] The electro-neutral salts are absorbed rapidly by the skin and function as emollients. They also act as fixatives for the perfume.

Self-emulsifiable oils

The term self-emulsifiable oils is applied to the homogeneous blends of surfactant, oil and amphiphilic agent (*e.g.* alcohol or phenol). Where the oil/water ratio is high, the emulsion is stable and can be sold in this form without fear of separation during storage. Such products are economical to transport, having a low water content and are sold as such for use in cutting oils, insecticides and disinfectants. In such cases the oil concentrate is added to more than 20 times its volume of water when required. The stability of an emulsion may vary with concentration for specific components. One which is stable with 10% oil phase may be unstable at 50%. An example is the solubilisation of kerosene and water by cyclohexanol. This takes place within a limited range of concentration of cyclohexanol. Solubilisation of oil and water with a surfactant can produce the following four types:

1 Separation of oil and water with the latter containing some solubilised oil.
2 Separation, with the oil containing some solubilised water.
3 Oil and water separated by a middle phase containing both components in solution.
4 Complete solubilisation in a single phase.

Micelles

In low concentrations the micelles of soap or syndet molecule are spherical, while at higher concentrations, they become distorted into ovaloids and finally into rods, when they are packed in layers at the interface of the oil and water phases. Oil is solubilised in water by enclosure within the micelles. As the oil concentration increases, so does the size of the micelle. A long chain soap molecule such as sodium oleate solubilises only a small amount of oil. To increase this solubilisation a long chain alcohol or phenol is added, resulting in molecular interaction between these latter additions and the ionic soaps by hydrogen bonding. Nonionics solubilise large amounts of oil without further additives. Self emulsifiable oils require low water content, must be easily dispersed and have reasonable stability when diluted with water to produce the final emulsion. For good stability the micelles must form a stable film at the interface of the two phases. This interfacial film is formed by absorption by the micelles from either or both phases and is in equilibrium with them both. In addition there must be molecular interaction as stated between the amphiphile and surfactant. The distribution of the surfactant and amphiphile between the two phases is determined by the HLB factor of the surfactant (the balance of hydrophobic and hydrophilic groups within the surfactant molecule). The solubility of the amphiphile in the aqueous phase can be controlled by addition of electrolytes. Another factor affecting stability of emulsions is temperature. The dispersion of a self-emulsifiable oil in water may cause an increase in volume of the aqueous phase.

Emulsion stability

The changes in specific (electrical) resistance and viscosity have been observed as a means of studying

emulsion stability.[6] The specific resistance plotted against amphiphile addition produces peaks at certain concentrations where separation of the phases occurs. These peaks are sharper and approach close together as the surfactant concentration is reduced, until finally at very low surfactant concentration the specific resistance shows a sharp continuously rising curve indicating no emulsification.

High foam surfactant

The synergistic action resulting from mixtures of anionics and nonionics can be obtained by converting a nonionic to an anionic by sulphation. When sulphated, the ethylene oxide adduct of lauryl alcohol produces a highly foaming surfactant which has found wide acceptance in shampoo formulations. In nonionics, the length of the ethylene oxide chain required to solubilise lauryl alchohol is about 6 moles ethylene oxide per mole alcohol. When sulphation is desired, only about 3 moles ethylene oxide per mole alcohol are required, the remaining hydrophilicity being supplied by the sulphate group.

Nonyl phenol polyglycol ethers have also been sulphated with similar results, but the most recent raw material entrant to this class is tridecyl alcohol which, as the sulphated ether, is being recommended for use in the preparation of various toilet articles and cosmetics. Tridecyl alcohol is made by the OXO process.

Sulphated ethers

A comparison of the efficiency of sulphated ethers has been reported.[8] Using sulphur trioxide, sulphamic acid and chlorsulphonic acid as sulphating agents, no difference in the final products or their performance was observed for the same ether. Varying amounts of ethylene oxide were combined with each of the hydrophobic groups before sulphating, and the optimum performance in all cases for foam stability and detergent efficiency was obtained with 3 to 4 moles ethylene oxide per mole hydrophobe. In general, the ammonium or sodium tridecyl alcohol ether sulphates were slightly superior in foaming and foam stability. The surfactants were mixed with an equal weight of dodecyl benzene sulphonate for test purposes. It is interesting to note that in distilled water the foam stability of these products was very poor, but in water of 135 to 360 p.p.m. hardness, the foam stability was excellent and independent of water hardness. When LDEA was included in the formula, foam stability was improved in distilled water, but as the hardness of the water increased the effect of LDEA diminished.

Sucrose ester

Another new type of nonionic receiving attention is the sucrose ester. The desired monoester, which is water-soluble, has to be separated from the undesirable diesters simultaneously formed as byproduct. This separation, followed by recrystallisation from alcohol or acetone, is costly. Some Japanese workers[9] have studied the conversion of these diesters into water-soluble products by reacting them with ethylene oxide. The products are similar to the *Tweens*. The diesters were prepared by reaction of sucrose with methyl esters of a series of fatty acids in formyl morpholine. The diesters were reacted with ethylene oxide in an autoclave using caustic soda or a tertiary amine as catalyst. The products were oily or waxy water-soluble products with surface-active properties similar to the *Tweens*. Toxicity tests indicated that they could be used in edible products as emulsifiers. The amount of ethylene oxide required to solubilise these diesters and to give satisfactory performance is 50 to 100 moles per mole diester.

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FERTILISERS and Plant Nutrients

By D. P. Hopkins, B.SC., F.R.I.C.

Effect of N, P and K on grass yield • Evaluating potash reserves • Uptake of plant nutrients • Potassium nitrate compounding and usage Glasshouse nutrition • New calcium metaphosphate process • Phosphoric acid ammoniation problem • Mixed fertiliser-weedkiller compounds Fertiliser practice for sugar beet discredited • Fertilisers for seed potatoes Excess Mn causes rice disease

Grass yield experiments

THE first section of a report on a multi-sited grassland experiment in Scotland has been published.[1] This involved the Hannah and the Macaulay Institutes, where experimental plots were set up for three years on six different sites. The main purpose was to assess effects of nitrogen, phosphate and potash on intensive production of grass for silage or drying, particularly (as the nitrogen influence is fairly well known) the effects of phosphate and potash applications. The sward at all sites was a mixture of commercial and certified varieties sown the year before the three consecutive years of actual cutting and yield measurement. All soils were slightly phosphate-deficient as judged by advisory methods of soil analysis. The two outstanding results were (*a*) the large degree of interdependence between nitrogen and potash and (*b*) the lack of influence of phosphate upon yields.

The rates of nitrogen given in this work were nil, 87, 174, and 384 lb./acre, and the highest rate is equivalent to 20 cwt. of 15·5% *Nitro-Chalk* per acre, applied in five equal dressings during the cutting season. Potash rates were nil, 168 and 336 lb. of K_2O per acre; phosphate rates were nil, 50 and 100 lb. of P_2O_5 per acre. The higher levels, of course, are exceed-

ingly intensive fertiliser rates for grassland treatment.

Nitrogen and potash interdependence

Though the importance of potash was shown, it would not have been discovered had rates of nitrogen over 100 lb./acre not been given. Even at the N rate of 174 lb./acre, the effect of potash upon the responses to nitrogen was not shown at all sites and it was not large; but at 348 lb. of N per acre the response to nitrogen was greatly raised by the application of potash, especially in the second and third years of cutting. This implies that at lower nitrogen levels the soils' potash supplies were adequate over the three years, but that potash additions were needed when nitrogen application was more intensive. The general results can be grouped under two headings—nitrogen used at different rates *with adequate potash*; nitrogen used at different rates *in the absence of additional potash*. For the former, the production of dry matter per lb. of N applied was relatively independent of rate of N—the overall mean result was between 14 and 15·7 lb. of dry matter per lb. of N applied. But for the latter group (where non-supply of potash leads to potash inadequacy) the response per lb. of N depended considerably upon rate of N, thus:

Rate (N/acre)	*Response/lb. of N*
87 lb.	15·0 lb. dry matter
174 „	13·7 „
348 „	10·0 „

With adequate potash, yields of dry matter were doubled by 348 lb. of N per acre/yr. The economic aspects of this result, based as it is upon several sites, seem important. The cost of 1 ton of the nitrogen fertiliser used will be about £13 5s. Adding the cost of potash to maintain adequate K, the total fertiliser cost might amount to £20 p.a. including costs of applying. This seems a relatively small outlay to double the production of cut grass from a three-year ley.

Yield unaffected by phosphate

The lack of phosphate influence is almost disconcerting, but it probably indicates that the phosphate reserve (in arable soils previously fertilised with phosphate regularly) can be satisfactorily utilised by grass sward roots. There were signs that in some cases the use of phosphate reduced the tendency for the N-response curve to flatten out, but the mean results from the experiment showed no significant positive phosphate effects. Had cutting continued for more than three years, the non-phosphate plots may well have revealed increasing effects of P-deficiency. However, all sites were *slightly* P-deficient as assessed by normal advisory test methods, and this is a possible indication that for grass these methods undervalue the availability of phosphate reserves. It would have been interesting if one or two sites had been *markedly* P-deficient.

The next report of this work will deal with the composition of the grass; this first instalment has dealt simply with quantity as dry matter.

Potash reserves

One of the current fields of fertiliser research—in the sense that increasing fertiliser use is focusing more attention on it—is the value of soil reserves. That there can be difficulties in evaluating soil reserves of phosphate has been indicated above; there are difficulties, too, in evaluating potash reserves. The use of extractant solutions to assess soil potash measures the exchangeable potash; it does not give any indication of the utilisation-capacity of the soil's fixed potash. A paper by Dr. G. W. Cooke (as yet unpublished) has suggested that the rate of release of fixed potash depends upon the amount of fine clay in a soil and upon the potash content of the fine clay. A contribution last year[2] reported a study of British soils with similar exchangeable-potash contents; it showed that their abilities to release fixed potash varied widely. An American paper[3] has discussed the dynamics of potassium release and fixation. Equations were tentatively established for rates of fixation and release, and it is suggested that minerals in soils (*e.g.* clays) have characteristic properties that determine their reactions with potassium. Release and fixation can occur simultaneously. In this research with 2 : 1 type minerals the rate of K fixation was found to be inversely proportional to the initial K content of the clay minerals. This investigation must be classed as very exploratory, but it is a forerunner of a type of soil nutrient research most likely to expand. As in the developed countries fertiliser use becomes more regular and often close to optimum rates for crops, the whole question of nutrient reserves and residue accumulations requires fresh study.

Uptake of N and other nutrients

There is evidence from studies of plant nutrition in solutions that the root exchange capacity (C.E.C.) is affected by nitrogen, *e.g.* calcium uptake is increased but uptake of monovalent cations is decreased. Some experiments have been carried out to check whether this also occurs in soil-supported nutrition.[4] Oats, tomatoes and buckwheat were grown in a sandy loam soil of *p*H 4·85; this *p*H was chosen so that calcium uptake was a critical nutritional factor. Coarse limestone was mixed in a layer of the soil. The addition of ammonium nitrate increased the ability of tomatoes and buckwheat to obtain calcium from the limestone, but this was not found with oats. With oats, nitrogen favoured increased potassium uptake. Since these results do not wholly agree with indications found from nutrient solution studies, it seems reasonable to conclude that when soil is present other influences besides C.E.C. and the Donnan membrane theory factor influence the nutrient uptake and any distinctions between di- and mono-valent cations. Nevertheless, it is possible that nitrogen's ability to increase uptake of other nutrients may partly explain why it is so often the most potent nutrient for raising yields and increasing plant protein contents.

In the long run, however, uptake of some nutrients seems to be more associated with the soil *p*H changes induced by nitrogen fertilisers than with direct influences. Another U.S. paper has shown[5] that zinc uptake during a four-year field test increased as the soil *p*H became acid and decreased as it became alkaline. The effects of different nitrogen fertilisers upon zinc uptake could be broadly correlated with their effects upon soil *p*H.

Potassium nitrate

In the competitive quest for more concentrated fertiliser materials for making high-analysis compounds, common chemicals should not be ignored. Potassium nitrate is a good example. Its fertiliser use is said to have been first suggested by Glauber in 1656! The pure salt offers 13·8% N and 46·6% K_2O; the natural mineral Chilean product, a potassium-sodium nitrate, contains about 15% N and 14% K_2O. Economic considerations have made potassium nitrate a relatively little-used fertiliser. High production costs have so far handicapped the synthetic pro-

duct, and the natural product, being so impure, is a non-concentrated fertiliser mainly used for specialised cropping. Recently fresh interest in potassium nitrate has arisen in the U.S.A. and it appears that a lower-cost production method is envisaged. This may be based upon reactions between nitric acid or nitrogen oxides and potassium chloride; if so, the process is similar to one used for making sodium nitrate. A recent paper[6] indicates that a potassium nitrate plant is scheduled for construction.

However, this paper considers in generous detail and with new experimental evidence the potentialities of potassium nitrate as a component of compounds. Its main advantage will be the provision of potash without associated chloride for crops like tobacco which are adversely affected if chloride accumulates in soils. Surprisingly, potassium nitrate is "among the least hygroscopic of fertiliser materials"—at 86°F. it does not start absorbing air moisture until the relative humidity is 90·5%, whereas potassium chloride does so at an R.H. of 84%. It forms mixtures with other fertilisers that are less hygroscopic than similar mixtures with potassium chloride unless ammonium salts are involved, when the cross-formation of ammonium nitrate will create higher hygroscopicity. Non-granular compounds containing about 16% of potassium nitrate were made and remained in good condition. Granular mixtures with up to 10% N content, using potassium nitrate as the potash source and a part source of N, had little or no caking tendency. The mixtures were also easy to granulate. A second U.S. paper[7] has also discussed potassium nitrate, but more from the viewpoint of use. Even potassium sulphate for potatoes is perhaps less desirable because over-supply of sulphur can cause leaf-tip burn; stronger evidence exists for regarding both chloride and sulphate of potash as less desirable for tobacco. The nitrate form of N in potassium nitrate is regarded as preferable to ammonium-N from other sources for potatoes and tobacco.

Glasshouse nutrition

A typically vigorous paper from Nicol[8] has restated the case for the pC approach in fertiliser practice, but with special application to glasshouse cropping. He points out that every fertiliser, manure, liming material, etc., produces contrary effects—(*a*) assisting growth by providing nutrients and (*b*) hindering growth by increasing the salt concentration in the soil water. The hindering factor is most easily measured by electrical conductivity (pC) and the grower should ensure that pC is seldom below 3. This, however, does not settle the balance of nutrients problem, and the view is advanced that the ratio by weight of anions to cations should be not less than 2·4—this ratio is called "G." Nicol attributes various tomato cropping troubles, *e.g.* blotchy ripening, potash-induced magnesium deficiency, to low G values in glasshouse soils. He gives the G values of single salts, in Table 1.

Table 1. G values of single salts

Salts bringing G below 2	*G.*
Potassium chloride	0·91
Potassium sulphate	1·23
Sodium chloride	1·54
Potassium nitrate	1·59
Salts raising G above 2	*G.*
Sodium sulphate	2·09
Sodium nitrate	2·70
Calcium bicarbonate	3·05
Magnesium sulphate	3·95

From these figures he advises the substitution of some potash by a sodium salt such as sulphate, or the provision of some of the nitrogen as potassium nitrate. The policy of high potash feeding in commercial glasshouses is criticised—unless the low G values of the chloride or sulphate forms are balanced with a material of high G value, nutritional problems are induced. The common cure for "high potash" troubles by using magnesium sulphate is, of course, explained by Nicol's table for G values; but he regards this as a clumsy and costly method for remedying troubles that can be avoided.

New calcium metaphosphate process

A process of hydrolysis for calcium metaphosphate has been developed by TVA.[9] Pulverised metaphosphate is slurried with hot water and acid is added to prevent over-thickening; the hydrolysed slurry is then usable as a phosphatic material and as a carrier of nitrogen through ammoniation in the further manufacture of compounds.

Curing erratic phosphate formation

Canadian studies[10] have shown that erratic insoluble phosphate formation when phosphoric acid is ammoniated to make ammonium phosphates is due to the presence of iron; solubility reversion of phosphate has been minimised by maintaining a high *p*H value during ammoniation.

Fertiliser-weedkiller combinations

The problems of mixed fertiliser-weedkiller products have been discussed[11] and it seems clear that enthusiasm for these products is more evident among farmers than most fertiliser manufacturers. The American trend may well be towards developing these dual-purpose products as liquids; despite some problems of incompatibility and "salting-out" of the herbicide, admixture is easier if the fertiliser itself is in liquid form and application errors are lessened. With liquid fertilisers already well developed in parts of U.S.A., both as straights and compounds, the possible movement of herbicide additives to this class of fertiliser could be detrimental to prospects for solid fertilisers.

Fertiliser practice for sugar beet . . .

Twenty-nine field experiments, 1957-59, have checked former indications that ploughing-down phosphate and potash in the autumn before sowing is a more efficient fertiliser practice for sugar beet.[12] The evidence from the new work has largely discredited this view. Wet and dry seasons occurred in the period, but in both conditions the normal spring applications of P and K gave better yields than autumn dressings in 20 of the 29 tests—in the other nine it is thought that evidence in favour of autumn treatment was anomalous and due to errors in measuring small differences.

. . . and seed potatoes

Fertiliser practice for seed potato growing in Scotland has been examined in 17 field experiments, 1956-59.[13] Up to 60 lb. of N per acre increased both seed and ware yields, but levels much above this reduced the proportion of seed yield. Potash considerably raised ware yields but it generally reduced the proportionate yield of seed at both moderate and high levels of potash use. Phosphate was more directly beneficial for seed production; on soils lowish in P, phosphate at 60 lb. of P_2O_5 per acre considerably raised seed yields, and on some sites

doubling this rate increased seed yield still further. Phosphate influence on ware yields was less marked, increasing this part of total yield only on the low-P soils. Optimum rates for seed production indicated by this work exceed the rates commonly used by Scottish growers. It would seem that N and K could often be reduced, but it might be dangerous to reduce P fertiliser rates.

Excess Mn causes rice disease

A rice disease of nutritional origin — leaf-tip drying — has been reported from India.[11] Affected plants were found to have nearly three times the manganese content of healthy plants, and this luxury uptake of manganese was associated with lowered N and P uptakes. It is apparently due to the high amounts of manganese in calcareous soils; when these soils are irrigated, much of the manganese dioxide in them is reduced to the manganous form, in which it acts as a readily exchangeable cation. Remedial measures are difficult, but adequate drainage to leach out the manganese is useful; an interesting device is the growing of sunflowers in rotation with rice, as sunflowers have a high demand for manganese and can be used as a fodder crop.

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Correspondence

The "Drop" Method of Capsule Manufacture

To The Editor,

Dear Sir, I was most interested to read the article by G. Müller on "Methods and Machines for making Gelatin Capsules" in your February issue.

However, it is a pity, that despite Mr. Müller's excellent resumé of the integrated rotary die capsulation units he should have based his remarks on the "drip process" on out-dated information.

Perhaps I may be permitted to describe more accurately the "drop" method of manufacturing seamless gelatin capsules on the Globex Mark II Machine. The machine consists of a cabinet divided into a "hot" and "cold" compartment. Molten gelatin (at about 60°C.) is passed at a constant rate through the outer of two concentric nozzles. A continuous stream of filler material is pumped through the inner of the two nozzles in such a way as to form a concentric, two phase, liquid stream. On emerging from the nozzle the stream passes into an immiscible coolant oil (*e.g.* medicinal paraffin, not turpentine) at about 4°C. and is then subjected to an intermittent circular pulsation at a variable rate (between 2 to 32 pulses per sec.). These pulses are sufficient to create an artificial constriction in the stream which will subsequently form into even-sized droplets through natural surface tension. The liquid droplets are rapidly carried away from the pulsator by a downward flow of coolant and are slowly congealed before being automatically ejected from the machine. The soft capsules are kept in the coolant to prevent them sticking together. The process does not require air conditioning and there is no need for recovery glasses.

The range of sizes extends from capsules of over $\frac{3}{4}$ gram down to micro capsules of between $\frac{1}{2}$ mg. to 37 mg. These micro capsules cannot be produced by any die or dipping process. The rate of production varies according to the size; capsules of 150 mg. can be produced at a rate of over 28,000 per hr., and capsules of less than 15 mg. in excess of 100,000 per hr.

No dies are necessary for the production of any specific size. *Any* size within the range can easily be produced by synchronising the rate of flow of filler with the number of pulsations per second. All the gelatin is used up and there is no loss of gelatin in the form of matrix, which results in important economies. Contrary to Mr. Müller's assumption, the process is suitable for the capsulation of a wide range of suspensions of solids in oils.



Formation of capsules by the "drop" method of manufacture.

Seamless capsules provide a perfectly hermetic seal and their excellent shell clarity results in exceptional brilliance of the finished product. Capsule hardness can be varied according to the proportion of softening agent (*e.g.* glycerine) incorporated. In some Globex plants drying is carried out in a heat exchange chamber, the only source of power being a 5 h.p. refrigeration compressor.

Although it is true that the rotary die process offers a wider variety of shapes, the Globex machine has several advantages particularly for pharmaceutical manufacturers who wish to produce their own specialities independently of large custom houses.

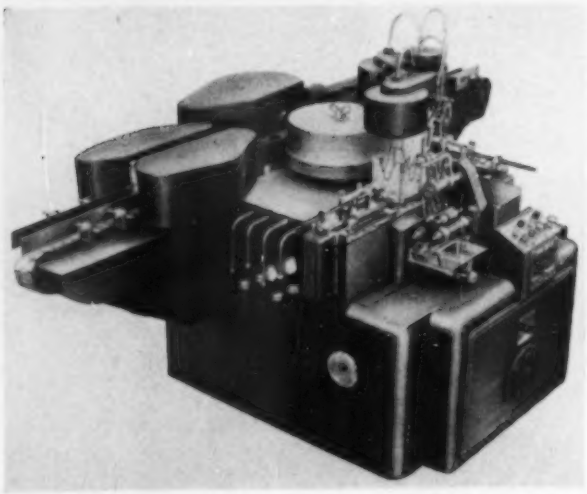
The capital investment required is a fraction of that required for die processes and much of the auxiliary plant required is standard and probably available already.

The process is relatively simple and (being fully automatic) cheap to operate. One girl can easily attend to two or three machines. The Globex process opens up new fields of capsule manufacture with the micro capsules. There are many novel applications for these capsules and the rate of production is being considerably increased. Hundreds of millions of seamless capsules are turned out annually on Globex machines which have now been installed in 14 different countries.

Globex International Ltd.

P. Briess *Director.*

Acton, London, W.3.



Automatic bottle labeller manufactured by Morgan Fairest Ltd. is available for labelling round or flat bottles.

▶INFRA-RED SPECTROPHOTOMETER

In the *Unicam SP.200* spectra are presented on foolscap charts which are ruled with scales linear in wavenumber and transmittance. The recorder is of the flat bed type and the chart carriage is drawn past the ball-point pen. The pen pressure is sufficient to produce carbon copies.

The scan, which covers the range 650 to 5,000 $cm.^{-1}$, is completed in ten minutes, only a few seconds being needed for resetting. Control, under normal conditions, is exercised by one small lever. The scan may be started and stopped at any point.

The photometer is of the double-beam null balancing type with a Nernst filament source. The radiation enters the monochromator at a frequency of 10 c.p.s. The slits are programmed to pass a level of energy which is constant over the range. The level of the programme may be varied in cases where, for example, there is strong absorption in the reference beam and the energy of the system restored to the normal level. A 60° rock-salt prism is used as dispersing element, and the radiation is finally focussed on to the Golay detector, whose advantages include a large receiving area and a uniform response throughout the wavenumber range. The electronics are mounted in three small chassis and a monitoring system is provided.

The *SP.200* is equipped with the standard type of slide mounts and will accept the majority of cells in use with infra-red apparatus, and a very wide range is available. With the use of a potentiometer accessory system and an external recorder scale, expansion of any chosen portion of the transmittance scale may be easily achieved. Fixed frequency scanning may also be undertaken.

▶LABELLER FOR FLAT BOTTLES

The Banks *Cyclone* manufactured by Morgan Fairest Ltd. is a high-speed (400 bottles/min.) body labelling machine for round bottles, but it can also be supplied for labelling flat bottles at a reduced speed of 120 bottles/min.

For flat bottles it is known as the *Cyclone Flat* and it will apply a maximum sized label of 5 in. wide by 6 in. deep to the front face or three sides of a flat, square or oval bottle.

It is compact and is sold complete with motor drive and vacuum circuit enclosed in the fabricated steel body.

A "no-bottle-no-label" device, mechanical overload and an infinitely variable speed are incorporated and an automatic dating attachment can be fitted.

Bottles pass through the machine at a steady speed in a vertical position, which simplifies installation into any production line.

The machine can be easily altered in minutes for a different bottle or label size. Cleaning down is also speedy and is simplified by all the change parts being located by dog or dowel.

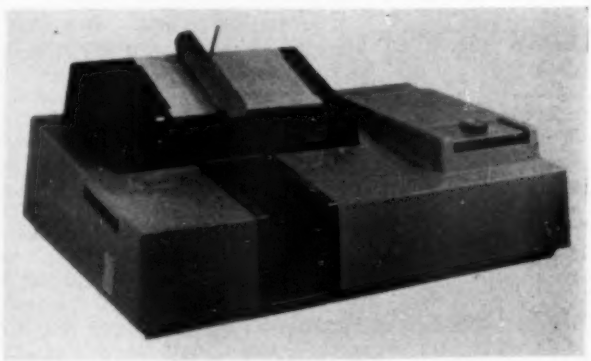
This machine can be easily converted to a high-speed labeller for round bottles.

The base of the machine covers an area of 52 in. × 45 in. and the sprocket centres of the conveyor passing through the machine are 92 in.

▶PERMEATION CELL

A new laboratory-scale membrane permeation cell incorporating recent developments in using selectively permeable membranes for changing the composition and separating components of fluid mixtures is available from Ionics Inc., a U.S. firm.

Membrane permeation is a new unit operation utilising membranes which permit easier passage of one or more of the components of a mixture relative to the remaining component. Appropriate selection of membranes and operating con-



Infra-red spectrophotometer equipped with standard type of slide mounts made by Pye Ltd. Most standard accessories can be used with this apparatus.

ditions such as temperature and pressure make possible the effective separation, for commercial purposes, of various components in industrial process streams.

Typical of the many applications which lend themselves to membrane permeation techniques are the breaking of azeotropes, separation of close-boiling mixtures, removal of water from organics and driving equilibrium reactions to completion. It is claimed that the new permeation cell makes possible process research investigations of promising commercial applications in the customer's laboratory.

In the standard cell all metal parts in contact with test fluids are stainless steel. The cell has a nominal volume of 0·4 gal. (1·55 l.) and an effective membrane area of 0·165 sq. ft. (23·8 sq. in.; 153·3 sq. cm.). Standard rated working pressure is 150 p.s.i.g. (11·6 kg./sq. cm. abs.) at 324°F. (163°C.). Higher pressure ratings can be supplied on request.

The cell is equipped with a heating mantle, pressure gauge, thermometer well, and may be operated on a batch or continuous basis. An internal chamber provides for rapid cooling and may be used as an alternative heating or temperature control system. A variable-speed stirrer promotes uniform temperature and composition.

▶ASEPTIC MIXING

When blending infected animal and human tissues at high speeds in a mixer or blender running at 8,000 to 16,000 r.p.m., scientists at the United States Army Chemical Research Station discovered that the operators were liable to be infected by the product.

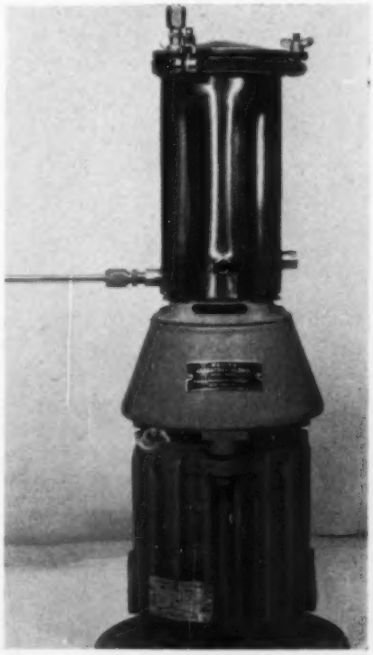
Waring Products Corp. investigated the problem and found that ordinary blenders created an atmosphere containing minute particles of the diseased tissues. The firm therefore produced a completely gas-tight mixing chamber, which had no leakages at any point.

The container, which fits on to a standard base, has a lid whose O-ring gasket and three thumbscrew clamps make it gas-tight.

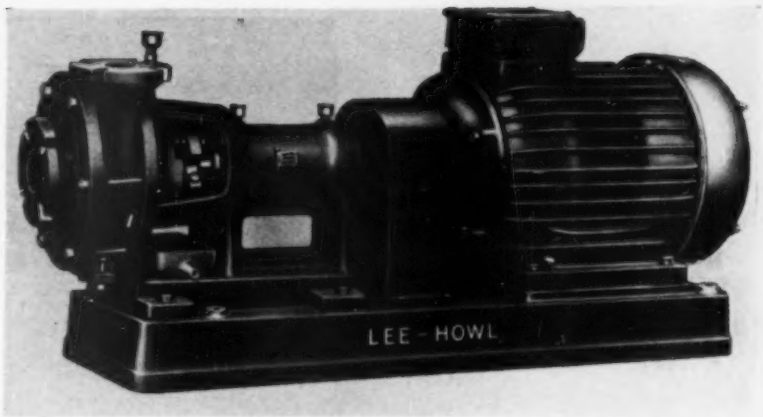
The difficult problem of preventing contamination of the bearing in the bottom driven agitator assembly, which drives the mixing blades, was solved by a special construction that eliminates either the upper or lower bearings of the drive acting as a fluid seal against any ingredients being blended.

The base of the container is jacketed, so that it may be either cooled or heated. Continuous flow blending is possible, while the aspirator tube may be used for sampling control. The machine, price £99, is available in the U.K.

All the parts of the container are of 18-8 stainless steel and every part of the container likely to come in contact with the contents is both corrosion-proof and essentially biologically inert.



The Waring aseptic container mounted on an explosion-proof motor base.



Corrosion-resistant liquids pump is suitable for the chemical and petrochemical industries as well as for effluent treatment plants. It is manufactured by Lee, Howl and Co. Ltd.

▶CHEMICAL-RESISTANT PUMP

The new 2 in./2½ in. *Hypersilid* chemical pump recently produced by Lee, Howl and Co. Ltd. (mentioned in MANUFACTURING CHEMIST, April 1961, page 167, "Pumps for Chemical Duties") is designed for handling corrosive liquids.

The pump is made from silicon iron castings and is suitable for the chemical and petrochemical industries as well as for installation in effluent treatment plants. It will handle sulphuric acid at any temperature or concentration, nitric, acetic, formic and phosphoric acids.

The outputs are: 153 ft. head—75 g.p.m. maximum; 80 ft. head—187 g.p.m. with maximum impeller diameter; 86 ft. head—65 g.p.m. maximum; 51 ft. head—150 g.p.m. with minimum impeller diameter. The speed is 2,900 r.p.m.

No wear rings are fitted, the impeller running clearance being generous, thereby avoiding rapid loss in pumping efficiency from wear and corrosion.

The pump shaft is made of *Staybrite* steel and is protected by a high silicon iron wearing sleeve. The impeller and shaft assembly can be quickly removed without disturbing any components. Two widely spaced ball and roller bearings are fitted in the substantial cast iron headstock. The casing is of the volute type, made from high silicon iron.

The pump can be fitted with a suitable soft gland packing or, if preferred, with a mechanical seal, both types readily interchangeable.

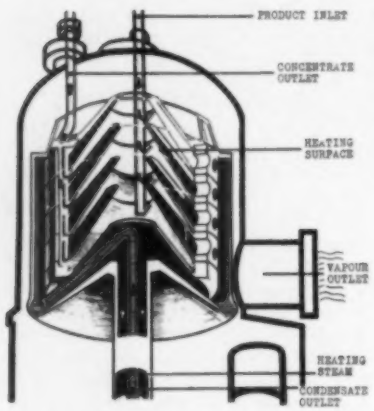
The volute casing and suction cover are tested up to 100 p.s.i. The drive can be by motor on a common baseplate or by V-belt.

▶EVAPORATORS FOR HEAT-SENSITIVE LIQUIDS

The *Centri-Therm* is a new evaporator for concentrating heat-sensitive liquids.

The heart of the machine is a stack of rotating cone elements which are supported on a hollow spindle. Each cone element is hollow, with stainless steel walls forming steam jackets supplied with steam through the spindle.

The liquid to be treated is sprayed on to the heated inner surfaces of the cone element at their top edges. Immediately the liquid touches the



Cut-away section of the Alfa-Laval Centri-Therm.

cone, the centrifugal force developed by the rotation spreads it in a thin layer over the entire inner surface. Since the centrifugal force built up in the *Centri-Therm* is up to 200 g., the thickness of the layer is only about $\frac{1}{10}$ mm. (0·004 in.) and the time taken to cross the surface is very short, just about 1 sec. The centrifugal force also keeps the lower surface inside the cone element free from condensate.

Because of the centrifugal force, the conditions at the heating surfaces are ideal both for heat transfer and for evaporation. The instantaneous discharge of condensate by centrifugal force from the steam-heated surface aids condensation, whilst the thinness and turbulence of the liquid layer ensures rapid heat absorption and virtually eliminates resistance to vapour leaving the layer. For these reasons the *Centri-Therm* evaporates a much greater amount of water per unit area than a non-moving evaporator and in a fraction of the time.

The concentrate from each cone element is gathered around the periphery of the cone element stack and is displaced upwards towards a paring tube which ducts it off. Evaporated vapours are led off under high vacuum through a large side outlet and the steam condensate is collected from the steam jacket by another paring tube.

The new evaporator is marketed throughout the world by the Alfa-Laval Group.

MECHANISM OF DETERGENCY

(*Continued from page* 269)

solid or liquid fatty alcohols or fatty acids are placed in solutions of sodium laurate or sodium lauryl sulphate and observed under the microscope, myeline forms are seen to be produced and the substance gradually reverts to a liquid crystalline phase which ultimately passes into solution. A phase diagram of the system, soap : cetyl alcohol : water shows the manner in which these myeline forms may develop due to the concentration gradient in the vicinity of the alcohol giving rise to a membrane of highly viscous liquid crystalline phase which is a result of the penetration of the crystal by the soap solution between the planes of the polar heads. If both polar and non-polar materials are present in the oil phase, penetration by the detergent will lead to spontaneous emulsification.

Finally Dr. Stevenson mentioned the osmotic effects produced by inorganic water-soluble soil on fibres partly covered by an oil film. In this case water can pass along the fibre and form water droplets within the oil film.

The lecture was illustrated by slides showing the action of detergent solutions on droplets of oil on single hairs, the formation of myeline forms from crystals in solutions, and also the osmotic effect.

Correspondence

Emulsifying Machinery

To The Editor.

Sir: Referring to the article on emulsifying machinery by Mr. Ridout, F.P.S., in Manufacturing Chemist, March 1961, I would like to bring to your notice a remark made by the author of this article which we feel is a popular misconception.

Referring to the Premier *Dispersator*, he says: "In common with all simple mixers, it tends to incorporate a lot of air in the emulsion." Our experience in the mixing field over a considerable number of years, in common with other mixer manufacturers, shows that provided a mixer is properly located in the mixing vessel when positioning the mixer, it produces an over-all turnover rather than the violent swirling of the vessel contents. At the same time, it should be remembered that on laboratory scale the relative diameter of the mixing head in relation to the vessel diameter—in this case either a beaker or a jug—is proportionally larger and this, of course, tends to aggravate the swirling of the whole mix and thus produces aeration.

While these remarks apply to mixers in general, I feel that our dispersator should not be classed with other types of mixing heads, since when properly used it can be shown that it will not incorporate air into the mix.

By way of example, many dispersators are used in the compounding of liquid foaming detergents and no frothing is experienced with prolonged mixing.

Finally, we feel that as 80% of our portable and semi-portable mixers are supplied with dispersators, the question of aeration occurring cannot be as serious as has been suggested.

Yours truly,

L. P. China,
Director.

Premier Colloid Mills Ltd.,
Walton-on-Thames,
Surrey.

Mr. Ridout makes the following comment:

"The article was written solely with the small-scale manufacturer in mind. Used under these conditions the *Dispersator* will tend to incorporate air into the emulsion and with this statement the manufacturers agree. When used on a larger scale the *Dispersator*, like the high-speed stirrers, can be arranged in the vessel so that it does not produce a vortex and consequently aeration will not be a problem."

American Commentary

NEWS AND VIEWS OF THE U.S. PHARMACEUTICAL INDUSTRY **by Dr. Rudolf Seiden**

Compulsory licences for drug makers proposed ★ Foreign names curbed ★ Dihydrostreptomycin caution Antibiotics in animal feeds ★ Industry's research effort ★ New drugs ★ Opportunity for chemical exports to The United States

SENATOR ESTES KEFAUVER and Representative Emanuel Celler have submitted a bill to Congress which, if accepted, will have great influence on the further development of the American drug industry; it is also assumed that it will lower drug prices.

The politicians propose (1) compulsory licensing of all new patented drugs and (2) revocable licences for manufacturers of ethical drugs. Industry spokesmen declare that the new legislation would be detrimental to the public interest in that it would seriously impair research and new product development.

The Kefauver-Celler bill would make it unlawful for the patent holder to select companies which are to be granted licences; moreover, it would require that all qualified manufacturers receive licences three years after the patent for a prescription drug was applied for, provided the licensees are willing to pay a royalty fee of up to 8%. The F.D.A. would licence all qualified companies to manufacture ethical drugs and it would establish official or generic names for drugs.

The Kefauver-Celler bill also proposes that prescription drugs consisting of more than one active ingredient and those developed by "molecular modification" no longer be patentable, except if the F.D.A. states that a drug combination exerts a definite synergistic action or a modified single drug possesses a significantly greater therapeutic efficiency than the original drug had.

Use of foreign names limited

The Federal Trade Commission has informed the manufacturers of cosmetics and toilet goods that foreign origin representations are permissible only for preparations which are *de facto* made abroad. Any implication of foreign origin—be it in products' names, illustrations, advertising phrases, etc.—of domestically manufactured merchandise is forbidden. By June 30, 1961, all labels of cosmetics and toilet preparations must conspicuously disclose their domestic or foreign origin.

In the past, American manufacturers often mixed ("blended") products so that they contained both domestic and imported ingredients; yet they promoted these preparations extensively in a manner which implied they were of foreign origin.

Dihydrostreptomycin warnings

New labelling requirements to assure the safe use of dihydrostreptomycin drugs and dihydrostreptomycin-streptomycin mixtures for human parenteral injection (subcutaneous, intramuscular, etc.) were recently promulgated by the F.D.A.

It was found that partial and even total deafness can result from the use of a much smaller amount of dihydrostreptomycin than was formerly believed.

According to the new requirements, the labels of dihydrostreptomycin-containing products must bear this warning statement: "For use only in patients who cannot tolerate streptomycin."

In the case of dihydrostreptomycin-streptomycin mixtures, the warning must read: "For use only in the treatment of tuberculosis in patients who cannot tolerate full dose of streptomycin."

Antibiotics in feeds

According to recent clarification of the complicated feed regulations of the Food and Drug Administration, feeds containing antibiotics (and other drugs) in minimum levels require certification, or an effective New Drug Application (NDA), or both. Only the remaining old-established drugs, which in the opinion of qualified experts have proved to be safe and effective, are exempt from these requirements, but they still fall under all the others contained in the Food, Drug and Cosmetic (F.D. & C.) Act, *e.g.* its food additives section.

These are required minimum amounts of the certifiable antibiotics that may be used in feeds:

Chlortetracycline, for blue comb, chronic respiratory disease, and infectious sinusitis of poultry—100 grams per ton of feed; for synovitis, the amount must be doubled.
Penicillin—100 grams per ton.
Bacitracin—100 grams per ton.
Streptomycin—75 grams per ton.

If used as growth promoters only—and not for the prevention or treatment of diseases—antibiotics may be used individually or in any combination at a level of 50 grams per ton of finished feed.

Each of the forementioned certifiable antibiotics, and oxytetracycline (which is not certifiable), can be used in certain animal species for growth promotion; namely:

Bacitracin—for chickens, turkeys, swine.
Oxytetracycline and *chlortetracycline*—for chickens, turkeys, swine, sheep, and cattle.
Procaine penicillin—for chickens, at 4 grams per ton minimum. The addition of antibiotics to duck, pheasant, pigeon, game bird, rabbits, and other feeds is prohibited.

At present larger amounts than the listed minimums are not to be used in feeds except if additional safety data for higher antibiotic levels have been reviewed by the F.D.A.

Drug research employs 13,000

It has been estimated that the American prescription drug industry employed close to 13,000 research workers—among them 7,200 scientists—and spent $215 million for new products developments in 1960; that is about 10% more than the amount spent in the previous year. Doctorates are held by approximately 20% of the industry's researchers. It is interesting that 83% of the total research manpower are employed by the 23 largest pharma-

ceutical firms, while the remaining 17% are employed by the hundreds of companies with annual sales of less than $30 million each.

New drugs

The following basic drugs have recently been developed; some of them are not on the market as yet:

Emivan, or ethamivan, a respiratory stimulant (U.S. Vitamins)
Celestone, or *beta*-methasone, a corticosteroid (Schering), and the closely related
Haldrone, or *para*-methasone acetate, a corticosteroid (Lilly)
Elavil, a tranquilliser (Merck)
W 1 N-18446, or N, N_1-bis (chloroacetyl) - 1,8 - octamethylene diamine, an antispermatogenic agent (Sterling-Winthrop)
E N-1530, or N-allylnoroxymorphone, a respiratory stimulant (Endo)
R O-1778/1, or 1-(*p*-chlorophenethyl)-6,7-dimethoxy-2-methyl - - 1, 2, 3, 4, - tetrahydroisoquinolone, an analgesic (Roche)
C I-427, or 1,2-dimethyl-3-phenyl-3 - propionoxypyrrolidine, an analgesic (Parke Davis)
S Q-4773, or N-(2-dimethylaminoethyl)-2-ethoxy-N-methyl-2, 2-diphenylacetamide, an analgesic (Squibb)
S U-8629, or 2-amino-indane, an analgesic (Ciba)
Akrinol, or 9-aminoacridinium-4-hexylresorcinolate, a fungicide (Schering)
Thiabendazole, or 2-(4'-thiazolyl)-benzimidazole, an anthelmintic for hair- and wire-worms in sheep and goats, intestinal roundworm and kidney worm in swine, and whipworm, hookworm and large roundworm in dogs (Merck).

Chemical imports may increase

Chemical exports from the U.S.A., which were far ahead of imports in the 1960s, seem likely to be reduced in 1961, while imports may grow. In 1960, total U.S. exports came to $19·4 billion, of which 8·68%—or more than $1·68 billion—were for chemicals; chemical imports reached only $353 million in 1960.

The major chemical imports of 1960 were: benzene, coal-tar colours, medicinals, menthol, vinyl acetate monomer, alumina hydroxide, ammonium sulphate, ammonium nitrate, sodium nitrate, urea, ammonium phosphate, and potash.

Chemicals in the Commons

A £350,000 Saving by Patent Breaking?

ACTION to reduce the cost of patented drugs to hospitals was announced last month.

Mr. Enoch Powell, Minister of Health, said he proposed to use Section 46 of the Patents Act, 1949, which enabled a Government department to use patented goods for the services of the Crown, in obtaining certain drugs for the hospital service either from manufacturers in this country or from abroad. (*See* p. 284 for fuller report.)

Earlier the Minister had been questioned about the prices at which hospitals were able to buy chlorothiazide, tetracycline and chloramphenicol from the Continent. He said some hospitals had bought small quantities of these drugs at £5, £37 5s. and £27 per 1,000 tablets, respectively. These prices were about one-third lower than those charged by suppliers in this country and over 12 months could save the hospitals £350,000.

Polio vaccine

Oral vaccine had only been used experimentally in the United States but had been widely used in Russia, stated Mr. Powell when questioned about information he had received from those two countries concerning the value of oral vaccine against poliomyelitis. He said the information available from these sources was taken into account by the Joint Committee on Poliomyelitis Vaccine in its recent advice to him.

Mr. Maurice Edelman (Labour, Coventry, N.) said the Sabin vaccine used in the U.S. had been administered in hundreds of thousands of cases and had given complete immunity, and in the Soviet Union a Sabin-type vaccine had been used in millions of cases and had given complete immunity.

Mr. Powell replied that the joint committee would, no doubt, advise him further, but its present advice was that the vaccination programme should continue to be based on the killed vaccine.

Heart disease

No tests with cod liver oil for the relief of coronary heart disease were being made under the Health Service, the Minister informed Sir Barnett Janner (Labour, Leicester, N.W.). The M.P., urging that tests should be made, said that the American Heart Council had stated categorically that it was effective in this type of disease.

Almost every affluent society in the world was "digging its own grave with its own teeth," commented Dr. Barnet Stross (Labour, Stoke-on-Trent, C.). He enquired what research was being conducted on the dietary of the nation. Mr. Denzil Freeth, Parliamentary Secretary for Science, replied that the Medical Research Council was supporting an extensive programme of research on problems of nutrition.

Chemical tankers

An M.P. drew attention to "the danger of vehicles carrying dangerous chemicals such as nitric and sulphuric acids and the ever-increasing size of these bulk-carrying vehicles." He urged the Home Secretary to limit the amount of chemicals which could be carried in them. Mr. R. A. Butler said that regulations introduced by the Transport Minister in 1955 placed a limit on the laden weight of a vehicle, and no further action was necessary.

Foot and mouth vaccine

The Governing Body of the Foot-and-Mouth Disease Research Institute, Pirbright, had been authorised to negotiate an agreement with the Wellcome Foundation Ltd., for the production at Pirbright of foot-and-mouth vaccines for sale abroad, stated the Science Parliamentary Secretary. The cost of the buildings required was estimated to amount to about £100,000 and would be eligible for grant-aid from public funds.

Chemical hazards to wild life

Earl Waldegrave, Joint Parliamentary Secretary, Ministry of Agriculture, Fisheries and Food, in a Lords debate, said long-range research into the problem would be dealt with in the report of the research study group, under Prof. Sanders, set up to examine the need for further research into the effects of toxic chemicals used in agriculture. Their report was expected this summer.

Official Methods of Analysis
of the Association of Official Agricultural Chemists. Ed. by W. Horwitz. A.O.A.C. Washington, 1960. *Pp.* 832. $18.

For 40 years now the Association of Official Agricultural Chemists has published an edition of its Official Methods at approximately five-yearly intervals. This ninth edition is a worthy successor to those which have gone before. Analysts in this country who are familiar with the book will find the new edition considerably enlarged in content although the volume itself is not much bigger than the previous one. The pages are certainly larger, but the major contribution to increased content has been achieved by the use of double columns of type.

As in the past, the book aims to give methods of analysis for a wide range of materials. The methods have all been subjected to collaborative study and, when a suitable degree of accuracy and reproducibility has been demonstrated, are adopted as "first action." Only later, when practice has proved its reliability, is a method described as official. This procedure ensures that the official methods are sound and based on broad experience. Naturally, the methods are not always those which an independent expert in a given field might use, since there are often more ways than one of carrying out a determination. In general, however, the collection of methods is one which might be used with confidence by any competent analyst. Throughout the book the methods are given in a uniform abbreviated style and without comment. Adequate references are made to source material, however, so that the reasons for the adoption of a given procedure can usually be found.

The scope of the book might come as a surprise to the new user, for its contents seem to belie its title. As well as chapters of methods on subjects which are recognisably agricultural there are also sections dealing with foodstuffs, drugs, cosmetics and so on. It must be stressed, however, that the book is not a complete compendium of methods, since the facilities and time for adequate collaborative testing are not always available. The absence of methods for certain pesticides such as dieldrin and a number of organo-phosphorus compounds are perhaps the most notable omissions, for these, surely, are of the utmost importance to the agricultural chemist today.

As with previous editions, this new version of "Official Methods" must be considered an essential part of the library of any analyst engaged in work on agricultural, food or pharmaceutical products.

C. A. Johnson.

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Style Guide for Chemists

By L. F. and M. Fieser. Reinhold Publishing Corpn., New York, and Chapman and Hall Ltd., London. Pp. 116. 24*s. net.*

This book has been written for chemists to help them write well. Fowler's "Modern English Usage" is adopted by the authors as their prime authority, and the book is illustrated with many examples of good and bad usage from the chemical field.

The first ten chapters deal with grammar, the choice of words, punctuation and style. Allowance must be made for expressions that are considered correct usage in America but not in Britain. Chapter 11 consists of five pages on proof reading and word division.

The remaining chapters are largely irrelevant to the main purpose of the book. Of the 20 pages of Chapter 12, "Pronunciation," 16 consist of lists of words and their (American) pronunciation, while the five pages of Chapter 13, "Speaking," are superficial. Unfortunately, too, the index has been inflated by the inclusion of all the words from the pronunciation and word division lists. These last pages detract a little from an excellent book which, if properly studied, should improve communication between chemists.

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Modern Chemical Processes

Vol. 6. *By the Editors of "Industrial and Engineering Chemistry." Reinhold. Chapman and Hall, London.* 1961. *Pp.* 126. 48*s. net.*

This is another collection of reprints of "staff-industry" articles that have appeared in *Industrial and Engineering Chemistry.* The articles are written by staff writers working with chemists and chemical engineers of the industry being studied. This is the best way of combining technical accuracy with journalistic expertness and the editors can take proper pride in the resulting articles which are certainly worth reprinting.

This volume contains 17 articles of varying lengths reflecting, no doubt, the willingness of different industries to subject themselves to searching technical enquiries. All but three articles describe American plants and processes. Two deal with German plants and one with a Canadian plant. The German plants described are the B.A.S.F. sulphur plant at Ludwigshafen (Fluidised Bed Roasting Ovens) and the Farbwerke Hoechst plant at Frankfurt (Chemicals from Acetaldehyde). The other "foreign" article describes the Dow Chemical of Canada plant at Sarnia (Glycols and Ethanolamines).

The five articles most likely to interest readers of Manufacturing Chemist are: Glycols and Ethanolamines; Detergents Continuously (Tide *et al.* at Proctor and Gamble); Phosphate Insecticides (Monsanto); Specialty Surfactants (Process Chemicals Co.); and 2,4-D Weedkiller and Derivatives (*Dow*).

The book has the same attractive format as the journal but it may be too big for some bookshelves.

45 million aerosol units



Standard 6-oz. tinplate aerosol containers made by Metal Box are used for these three new Cooper products. Equipped with Metal Box standard precision valves protected by high density polythene covers, the cans are offset printed in three colours over a white coating.

In eight years the production of aerosol packs in the U.K. has increased nearly fifteen-fold. In 1954 production was 3·5 million units; last year it was 45 million. This year it will probably be higher still.

It has been estimated that insecticides and space sprays account for 40% of aerosol output. Air fresheners account for 20% and household products 19%. Cosmetics and toilet goods (10%), mothproofers (7%) and industrial products (4%) are the other major products packed in aerosol units.

Nine types of pharmaceutical products and 18 veterinary products are packed in aerosols. Here is a list of aerosol products currently made in Britain:

Household, etc. (22)
Space insecticide
Residual insecticides
  Ant and crawling insect killer
  Mothproofer
  Woodworm killer
  Garden spray
  Greenhouse spray
  Insecticidal lacquer
Air freshener
Furniture polish
Window cleaner
Weed killer
Spot remover
Fur cleaner
Mop spray
Artificial snow
Paints and lacquers
Butane refills for stoves
Fire extinguisher
Waterproofing sprays
Shoe polish
Suede cleaner and reviver

Pharmaceutical (9)
Cold relief
Asthma relief
Plastic bandage
Topical spray
Antibiotic powder
Local anæsthetic
Germicidal spray
Rheumatism relief
Foot freshener

Veterinary (18)
Foot rot sprays
Lice spray
Cage bird spray
Insect repellant
Ringworm spray
Dermatitis spray
Anti-pigfight spray
Spray bandage
Food additive
Cattle dressing
Dog coat reconditioner
Deterrent for bitches in season
Udder cerate
Lungworm spray
Screw worm spray
Sheet maggot spray
Local anæsthetic
Dog shampoo

Cosmetic (13)
Hair lacquers and sets
Perfumes
Colognes
Personal deodorant
Men's brilliantine
Hand cream
Sun tan sprays
Sun tan foam
Shaving foam
Toothpaste
Nail dry
Insect repellant
Powder

Industrial & Automotive (21)
Lubricating oil
Penetrating oil
Mould release
Antistick agent
Flaw detector
Anti-tracking agent
Anti-static
Belt dressing
Ink anti-oxidant
Rust inhibitor
Degreasing fluid
Solvent
Cutting oil
Stencil ink
Developer
De-mister
De-icer
Dampstart
Diesel starter
Chromium protective lacquer
Car polish

Miscellaneous
Artists' pastel fixative
Dry-fry (food)

Some products packed in Aerosols overseas but not yet in Britain include:
Chocolate whip
Whipped cream
Caramel topping
Garlic whip
Horseradish whip
Meat tenderiser
Fruit juice concentrate
Egg spray preservative
Mouth freshener
Liquid detergent
Spare air for motor tyres

New atomising spray head

Fibrenyle Ltd. have introduced a new liquid atomiser and cap. The main feature is the placing and marking of the



The new atomiser supplied by Fibrenyle Ltd. The clearly defined arrow enables the user to ascertain direction of spray even in the dark.

dispensing hole. This is clearly defined on the centre boss and a highly embossed arrow indicates the direction of the spray. It is possible in poor light or total darkness, by feel alone, to determine the direction of spray.

The dispensing head has a ribbed finish on the sides. The cap, which is a sliding fit, has an internal sealing tube which slides over the dispensing boss, thus ensuring a leak-proof head. The dispensing head is in black plastic, the metal cap having a gold finish. At present these atomisers are only supplied with the standard 4 oz. tubular polythene bottle.

New aerosol can

Recently John Dale Ltd. produced a new one-piece aerosol can with the valve neck orifice curl turned outwards as a means of overcoming corrosion associated with the anodising of aluminium containers. This can now has a new style shoulder formation which maintains completely the outward curled neck so that at no time does the metal curl inwards to form a possible trap on the inside of the container.

The manufacturers maintain that the tolerance to which they can produce enamel decorated containers with this new shoulder is comparable in every way with that of a standard 1 in. orificed tinplate container. This should prove an advantage to users of these containers on filling lines at the valve crimping stage.

Polystyrene tubes for smoking deterrent

Lobidan tablets, a new smoking deterrent by Uni-Pharma Ltd., are being packed in attractive polystyrene tubes manufactured by the plastics group of the Metal Box Co. Ltd. Each tube contains 15 tablets.

The red-and-white design with clear black lettering is printed by the flexographic process. The decoration is the same on both the cartons for single tubes, and on the display outers.

New propellent prevents aerosol corrosion

Aerosol container corrosion, caused by the reaction of Propellent 11 with ahydrous ethyl alcohol, may now be prevented, through a newly introduced propellent formulation containing a special stabiliser. This has been announced by Du Pont " Freon " products division.

The new compound—" Freon-11 " S Propellent—is standard " Freon-11 " (trichloromonofluromethane) to which has been added 0·3% nitromethane.

Except for the addition of the nitromethane inhibitor, the new propellent has the same composition as " Freon-11 " and will be sold for the same price. It is available in standard commercial quantities.

" Freon-11 " S is believed to be compatible with most aerosol products now on the market. Use of the new formulation appears especially advantageous for such aerosols as hair sprays and other personal products, room deodorants, and plant sprays.

In the case of pharmaceutical and cosmetic applications, approval of appropriate local authorities may be required before products using it can be sold.

The development of nitromethane as a stabilising agent resulted from research carried out to determine the cause of corrosion in nonaqueous products containing ethyl alcohol and Propellent 11. In the past it had been thought that this corrosion was due to hydrolysis caused by the small amount of water in the mixture.

Du Pont established that, on the contrary, the major cause of corrosion is the reaction of Propellent 11 and ethyl alcohol. Nitromethane was selected as the most effective of the numerous stabilising compounds which were screened in the course of the investigations, and a patent on its use has been applied for. Tests by the company show that " Freon-11 " S has the same low level of toxicity as " Freon-11."

Glass container sales rise

Sales of glass bottles and jars in 1960 once again improved on the previous year's figures, attaining a record level of 4,468 million units, an increase of 7·5% over sales in 1959 and of 43% over the ten years since 1950.

The pharmaceutical industry absorbed 798 million units and the toilet and perfumery trade another 359 million units. A variety of other industries, such as those packing oils and household cleaning materials, accounted for 325 million units.

Glass container manufacturers are constantly striving to improve quality. Five of the latest type of jam jars, for example, weigh no more than two of the old kind and yet are in fact stronger. New designs are continually being introduced to bring out the inherent attractiveness of the material and to enhance the product it contains.

Giant polythene container

William Freeman and Co. Ltd., manufacturers of the *Freeflex* Standard range of blown polythene containers, have added a 5 gal. container in high density polythene, complete with carrying handle, to their range of standards for delivery from stock.

This container, despite its size, is extremely rigid and, it is claimed, stands up to the most stringent conditions and is inert to a wide range of chemicals.

Foil sachets for shampoo

White Rain shampoo made by the Toni Co., previously packed in transparent plastic, is now being marketed in aluminium foil sachets printed in three different colours—blue for the dry hair formula, green for normal hair and red for oily hair.

The bottles are no longer being marketed in the old green and yellow shaped cartons, the bottle itself with a new label presenting a more attractive pack.



This improved talcum powder tin introduced by Roberts Windsor Ltd. retails at 2s. 11d. The new pack is larger and allows greater ease of handling. Perfume availabilities remain unchanged.



Foil sachets replace transparent plastic for this shampoo. Bottles have new labels and are sold without cartons.

Minister to buy patented drugs from unlicensed makers for hospitals

Government will break patents to cut N.H.S. costs

Drugs made by unlicensed manufacturers abroad which can be sold at lower prices than those made by licensed manufacturers which carry a royalty payment, are to be bought centrally for hospitals by the Ministry of Health. The Minister gives two reasons for doing this: to cut the drug bill and to ensure that any drugs bought from unlicensed sources are up to standard. Individual hospitals which have been buying drugs from unlicensed sources must stop forthwith. The implication is that such drugs have been escaping royalty payments, so that the Minister's action can be construed as safeguarding the interests of the patent holders because when unlicensed drugs are bought in future royalty payments will be negotiated directly with the patentees.

The Minister is able to take what is virtually patent breaking action by invoking section 46 of the Patents Act which enables the government to use patented goods "for the services of the Crown." Normally this power is invoked in time of war. In the present case it can be applied only to the hospital services, not to drugs bought from prescription chemists.

The new scheme will at first be applied to three groups of drugs:

tetracyclines,
chloramphenicol, and
chlorothiazides

It is estimated that hospitals now spend £1 million of the £14 million a year they spend on drugs on these products. Based on unlicensed prices a saving of £350,000 a year less royalty payments could be made. The reduction would apply only to hospital supplies, but it would soon trim the prices of these drugs sold on prescription.

In future tenders for the supply of these drugs under central contract will be invited by the Ministry by advertisement. It will be open to both British manufacturers and to importers to tender. The Ministry will settle royalty payments with the patentees and in the event of disagreement the matter will be taken to the High Court.

The Minister says that the scheme will not prejudice patent protection for the development of the British pharmaceutical industry. The industry emphatically disagrees. The A.B.P.I. says that if it so reduces prices as to make research prohibitive it will make it impossible for the industry to compete abroad. The Association will therefore insist that patentees get a proper reward for the Crown use of their inventions.

The threat to the industry has been emphasised in many newspaper comments.

Mr. F. Goulding, a director of Pfizer Ltd., manufacturers of tetracyclines, says that the Minister will compulsorily deprive pharmaceutical companies of private property acquired at great expense. "This deprivation . . . on grounds of mere expediency is fundamentally at variance with Conservative political principles," he says.

Dr. R. W. Cope of University College Hospital, London, in a letter to *The Times* condemns the Minister's "subtle manœuvre" as being quite disgraceful, and observes that the pharmaceutical industry is being poorly treated for its generous grants to hospitals and medical research. He fears that the Minister will destroy the incentive towards research on new drugs.

Fisons-Esso £4m. NH_3 plant

A new joint company is to be formed by Esso Petroleum Co. Ltd., and Fisons Ltd., on a 50 : 50 basis, to produce 150,000 tons of ammonia a year on a 5-acre site immediately adjacent to the new Esso refinery at Milford Haven in Pembrokeshire.

Work on the erection of this new plant, which is estimated to cost about £4 million, will begin shortly. Nitrogen products will be manufactured from the ammonia supplied by this plant to another new wholly-owned Fisons plant, which is to be built on a separate 40-acre site near the ammonia plant, and a short distance away from the refinery. The two plants will be connected by pipeline.

It is anticipated that both the ammonia and the nitrogen plants will be in commission by spring 1964. At the ammonia plant regular employment will be provided for about 50 people, and at the nitrogen plant for about 200 people, most of whom it is hoped to recruit from nearby areas in Pembrokeshire.

Enlargement of Tees-side petrochemicals complex

I.C.I. Ltd. will build a plant capable of distilling about 1m. tons of crude oil annually on a Tees-side site of 250 acres. Agreement has been reached with Shell-Mex and B.P. Ltd. whereby they will make available to I.C.I. the crude oil for processing. The plant will cost several million pounds and is due for completion before the end of 1962.

The Heavy Organic Chemicals division will be responsible for building and operating the distillation plant. The light distillate (naphtha) produced will provide a proportion of the feedstock requirements for the division's three olefine plants at Wilton, whilst other products will be marketed by Shell-Mex and B.P. Ltd.

The existing pipeline system linking the I.C.I. works at Wilton and Billingham, which together form the largest petroleum chemicals complex in Europe, runs alongside the new site, so that transfer of refined products to either will be facilitated.

Fisons reorganise overseas interests

Fisons have re-grouped their overseas chemical activities. In recent years exports have been organised by Fisons Chemicals (Export) Ltd. This company has been reorganised and the name changed to Fisons Overseas Ltd. and will control the whole of the overseas activities of all companies in the chemical division. Overseas sales of these companies account for nearly 40% of the total chemical division sales.

Mr. A. Wormald, a managing director of Fisons Ltd., will be chairman of the new company with Mr. A. Robinson as deputy chairman and Mr. W. Abel Smith and Mr. H. J. Kahn as managing directors.

New process for maleic anhydride

The Heavy Organic Chemicals division of I.C.I. is to construct a maleic anhydride plant at the company's Wilton Works on Tees-side. A new process will be used in which butene is oxidised with air, and the plant will have a capacity approaching 10,000 tons/year of maleic anhydride when fully developed. The construction of this plant is a further step in the utilisation as chemical raw material of the butenes obtained from the Division's olefine plants at Wilton.

Maleic anhydride is an important raw material in the production of resins for reinforced plastics and surface coatings. It is also used in the preparation of agricultural chemicals, insecticides and other derivatives.

Perlite filteraids from Europe

At Ghent a new plant for the production of perlite filteraids has been set up by Dicalite Europe Nord, a subsidiary of Great Lakes Carbon Corporation. The products are marketed in the U.K. by F. W. Berk and Co. Ltd.

Perlite is a dense glassy rock formed by volcanic action. When crushed and heated under proper conditions, it expands to twenty or more times its original volume. Further treatment produces a mass of irregular fragmented particles which interlock to form a virtually incompressible filter cake of 80% to 90% void space, capable of screening particles of less than one micron in size.

In many cases it is possible to use 25% less filteraid than with conventional diatomaceous earth, without any reduction in filtering capacity. In addition, it has proved remarkably efficient in filtering liquids containing a high percentage of dispersed solids. Due to the unusual physical characteristics of its particles, Dicalite perlite is highly resistant to cracking when applied as a pre-coat on rotary vacuum filters. It is essentially inert, insoluble except in strong acids and alkalis, tasteless and odourless.

Dicalite perlite filteraids are used in the filtration of a very wide variety of liquids. They have been found most effective in the chemical, pharmaceutical, vegetable and mineral oil, and sugar industries, and for water treatment generally.

Gas chromatography symposium

The 4th International Symposium on gas chromatography organised by the Analytical Chemical division of the Gesellschaft Deutscher Chemiker and the Gas Chromatography discussion group of the Hydrocarbon Research group of the Institute of Petroleum will be held at Hamburg from June 13-16, 1962.

Papers presented should be similar in form to those at former symposia and will be classified under 1. Theory, 2. Apparatus and techniques, 3. Applications. Preliminary registration should be sent to Gesellschaft Deutscher Chemiker, c/o Dr. W. Fritsche, Frankfurt/M, Postfach 9075.

Phthalic anhydride plant

Grange Chemicals Ltd. plan to erect a plant to manufacture about 15,000 tons p.a. of phthalic anhydride. Until recently this material has been manufactured from naphthalene, a product of the coal tar industry. The raw material for the Grange operations would be orthoxylene, which will be produced by a company, jointly owned by the British Petroleum Co. Ltd. and California Chemical Co., in the plant to be built at BP's Kent refinery.

F. J. Stokes' U.K. subsidiary

F. J. Stokes Corporation of Philadelphia, Pennsylvania, has established a subsidiary company in Great Britain. The new subsidiary will manufacture some of Stokes' wide range of machines and equipment for the plastics, chemical, pharmaceutical, automotive, electronics and food industries. These machines will be available throughout the British Isles, the Commonwealth, and countries of E.F.T.A.

Factory health services

Eighty to ninety per cent. of factories in most European countries employ less than 100 workers. Because these factories are so small they have as a rule no industrial health services; hence, supervision of working conditions and sanitation is poor and there is no medical and nursing care. The accident rate in small factories is more than twice that of the larger ones, where proper health services are available.

Of the 220,000 factories in Britain, 150,000 employ ten or fewer workers. More than a million people there work in factories employing 25 or less, the number of such factories having nearly doubled in the last 25 years. In Italy, 95% of industrial plants have less than 100 workers, in Switzerland 90%, in Belgium 96%, in Denmark 99% and in Sweden 92%. In the Netherlands, about 50% of the workers have no access to industrial medical care.

The provision of health services for small industrial concerns is thus a matter of great importance, and a number of different ways of organising such services have been developed in various parts of Europe.

These were studied at a conference in Dublin called jointly by the Regional Office for Europe of the World Health Organisation and the International Labour Organisation. About 40 experts, including representatives of employers' and workers' organisations from 22 countries, participated in this meeting.

Eye disease due to hydroquinone

The list of prescribed industrial diseases has been extended to include ocular ochronosis due to exposure to quinone or hydroquinone. A person contracting the disease at work will now be covered for the benefits of the Industrial Injuries Scheme.

" Ocular ochronosis " is a condition which has been found to affect the eyes of workers engaged in the manufacture of hydroquinone powder. The disease involves damage to the cornea and some discoloration of the eye. It is ordinarily halted in its early stages, before severe or permanent damage has resulted, but there have been a few cases in which vision has been permanently impaired. Although the disease is rare and stringent precautions are taken, occasional cases of it have occurred during the last few years.

Luwa in the U.K.

Luwa (UK) Ltd., a British subsidiary of Luwa A.G., Zurich, Switzerland, have commenced business at Reliance House, 340 Clapham Road, London, S.W.9 (telephone: MACaulay 7776), as suppliers of plant in the U.K. based on the Luwa thin film evaporating machine and the Luwa rotary high vacuum fractionator.

Staveley Industries Ltd.

Staveley Industries Ltd. is the new name for the Staveley Coal and Iron Co. Ltd.

The 27 companies in the Staveley group now operate in three broad fields: general engineering and foundries; machine tools; salt, lime and allied products. These companies include: Beswick's Lime Works Ltd., of Buxton; Birmingham Chemical Co. Ltd., Lichfield and the British Soda Co. Ltd., Sandbach, Cheshire.

Industrial weed control conference

In view of the growing need to establish the economic importance of controlling unwanted vegetation on industrial and civic sites and of the importance of making widely known the latest developments, the British Weed Control Council in conjunction with the Pesticides Group of the Society of Chemical Industry will hold a symposium on Friday, June 30, in the Assembly Hall of the Royal Commonwealth Society, Northumberland Avenue, London W.C.2.

Effluent problem collaboration

An arrangement has been made between Head Wrightson Processes Ltd. and the *Alfloc* water treatment service of I.C.I. whereby the two concerns will collaborate in the assessment and solution of problems relating to treatment of trade and other wastes before discharge to sewers or watercourses. In addition, a special study will be made of the re-use of water within industry with the view to alleviating problems of water supply and of disposal of wastes.

Charcoal merger

Farnell Carbons Ltd. of Woolwich, manufacturers of activated carbons, have now joined the Forestal group of companies of the Adelphi, John Adam Street, London, W.C.2. This acquisition forms part of a programme of diversification being carried out by Forestal and is an extension of existing overseas interests in charcoal manufacture.

Farnell Carbons Ltd. will continue to operate from Woolwich, but the range of manufacture will be extended to cover all types of activated carbons. In particular, the company will supply chemically activated carbon manufactured by Forestal, thus creating a new source of supply for this material in the U.K.

Norman Marsh, technical director and vice-chairman of Ayrton, Saunders and Co. Ltd., manufacturing and wholesale chemists, of Hanover Street, Liverpool, has been elected chairman.

On May 13 at Antioch College, Yellow Springs, U.S.A., the Patterson award was presented to **Dr. G. Malcolm Dyson** of Loughborough, Leicestershire. It is made every two years in honour of the late Dr. Austin M. Patterson who was, for a time, editor of *Chemical Abstracts*, and for many years scientific editor of Webster's Dictionary. This is the first time the award has been given to a non-American. Dr. Dyson acts as consultant director of research to *Chemical Abstracts*. He is carrying out extensive research in the storage and retrieval of scientific data by computer techniques and has devised many technical advances in this subject. It is for this work he has been honoured.

Sir Harold Roxbee Cox has been appointed chairman of the Council for Scientific and Industrial Research for five years from October 1 next. He will succeed **Sir Harry Jephcott,** who has been chairman of the council since its formation in 1956. Sir Harold Roxbee Cox joined the board of the Metal Box Co. in 1957. He was appointed deputy chairman in 1959 and became chairman in January this year.

Ernest N. Pullom, editor of *The Pharmaceutical Journal*, left the service of the Pharmaceutical Society on May 31 to take up a new appointment, that of pharmaceutical editor with Intercontinental Marketing Services Ltd. which is engaged in market research and advertising. Mr. Pullom was appointed editor in 1957, and during the four years he has been with the paper, major changes have been made in the layout and typography, and there has been an expansion of the news coverage, particularly in the political, industrial and overseas sections.

Prior to joining the journal he was for six years editor of the Export Review of the British Drug and Chemical Industries.

Rexall Drug Co. have appointed **Maurice Richardson** as managing director. He joined Rexall in 1928 and was export director of the company.

Sir Arthur Vere Harvey, M.P., has been appointed to the board of CIBA Ltd., Basle. This is the first time that an executive of the CIBA group of companies in Great Britain has been made a director of the parent company.



W. R. Norman



D. H. Carter

Derrick H. Carter has been appointed chairman of I.C.I. General Chemicals division in succession to **Harold Smith,** whose appointment to the I.C.I. main board was announced recently.

Mr. Carter is succeeded as joint managing director (commercial) of General Chemicals division by **John L. Tedbury,** a director of the Division. Mr. Tedbury is at present also deputy chairman and joint managing director of Plant Protection Ltd., an I.C.I. subsidiary company.

C. Pugh has been appointed to the board of County Laboratories Ltd. and will act as product research director.

Samuel W. McCune, general sales manager of the Du Pont Co. (United Kingdom) Ltd., has been promoted to deputy managing director.

S. W. Martin has relinquished his position as managing director of the Staveley Iron and Chemical Co. Ltd., but continues as chairman. He will be succeeded as managing director by **N. C. Macdiarmid,** a director of Stewarts and Lloyds Ltd., who joined the Staveley board in September 1960.

W. N. Menzies-Wilson has been appointed deputy managing director.

P. S. Linklater has been appointed general manager of Shell Chemical newly-formed Administration and Co.'s Services division. He will be responsible for the general administration of Shell Chemical Co.'s commercial services, legal, personnel, publicity and general services departments.

W. E. K. Piercy, development director of Albright and Wilson Ltd., has been appointed to the board of W. J. Bush and Co. Ltd. The appointment of **Eric Bush** to the board of Albright and Wilson was announced on March 29.

Boots Pure Drug Co. Ltd. have appointed **Willoughby R. Norman** chairman and **F. A. Cockfield** managing director of the company.

G. F. Sommerville, manager of their Baronet Works, Warrington, has been appointed a director of Laporte Chemicals Ltd. A graduate of Glasgow University, Mr. Sommerville joined the company in January 1957 in connection with the commissioning of the organic chemical process for the manufacture of hydrogen peroxide. He had previously spent seven years in the oil industry.

G. G. Thompson has been appointed a director of the Birmingham Chemical Co. Ltd., of Lichfield, a member of the Staveley group of companies. He is on the board of the parent company, Staveley Industries Ltd., and is managing director of the British Soda Co. Ltd., Sandbach, another member of the group.

Consequent on the appointment of **Dr. R. Spence,** F.R.S., as deputy director of the Atomic Energy Research Establishment, Harwell, **Dr. W. Wild** has been appointed head of the chemistry division. **A. A. Smales,** head of the analytical chemistry branch, has been given the status of a division head and will be directly responsible to the Director, A.E.R.E.

Lord Rothschild, F.R.S., a director of "Shell" Research Ltd. since 1959, has been appointed vice-chairman. In this capacity he will continue as a scientific adviser and will become the company's principal representative in matters relating to academic, government and private research in Britain when the present general manager, Dr. C. G. Williams retires in October.

Lord Rothschild is an assistant director of research in the Department of Zoology, Cambridge University, and he will continue with his work there in the field of biophysics. He was a Lieutenant-Colonel in the Intelligence Corps in the war and was awarded the George Medal for bomb disposal work.

G. R. Buckley and **E. M. Summers,** directors of the Stanton Ironworks Co. Ltd., **E. M. Marvill,** director and general manager of the Sheepbridge Co. Ltd., and **R. F. A. Turner** have been elected directors of the Staveley Iron and Chemical Co. Ltd. Mr. Turner has been appointed general manager of Staveley works. The appointments have been made following the resignation of **S. N. Turner** and the retirement of **C. H. M. Owen.**

G. V. Taylor, works manager at the Newport factory of Monsanto Chemicals Ltd., retired on June 1. He is succeeded by **A. C. W. Pemberton,** general superintendent of technical services at Monsanto's Fawley factory.

D. J. Flunder, general purchasing manager of the Dunlop Group for the past two years, is to become general manager of the Chemical Products division in Birmingham. He will succeed **N. G. Bassett Smith**, who is to become general manager of the Dunlop Footwear Co.

British Hydrocarbon Chemicals Ltd. have appointed **J. G. Hill** as works manager at their Baglan Bay factory, with effect from July 1. He has been plant manager of Forth Chemicals Ltd. at Grangemouth since 1951, and during this time Forth Chemicals have expanded their capacity from 10,000 t.p.a. to 50,000 t.p.a.

Sir Robert Hall, until recently Economic Adviser to H.M. Government, has been appointed an adviser to Unilever.

Norman C. Fraser (deputy chairman of W. J. Fraser and Co. Ltd.), the retiring chairman, was re-elected chairman of the British Chemical Plant Manufacturers Association at the annual meeting.

W. M. Keightley, deputy pharmaceutical production manager of the Boots Pure Drug Co.'s Beeston factory, Nottingham, has retired. He joined Boots in 1918 in the analytical department and transferred to the pharmaceutical factories in 1937.

Consultants elect new chairman

The Association of Consulting Scientists has elected the following honorary officers:

Chairman: Dr. M. Barent (Barent and Johnson).
Vice-Chairman: F. G. Sarel Whitfield (Avebury Research Laboratories Ltd.).
Hon. Treasurer: Dr. G. W. Ferguson (Parry and Ferguson).
Hon. Secretary: W. H. Stevens (W. H. Stevens).

The Association, which already has members in the British Commonwealth as well as in the U.K., is to review the desirability of affiliation with the Union Internationale des Laboratoires Indépendants as the representative Association of the British Commonwealth.

OBITUARY

The Board of Reichhold Chemicals Ltd. have announced the death of their chairman, **Walter Hugo Breuer,** in a motor accident.

THE CHEMICAL MARKET

This month's changes

LONDON.—There are few changes in price this month. Of the fine chemicals, **ascorbic acid** is up by 11s. to £3 17s. 6d. kg., **silver nitrate** is up by ¾d. to 5s. 2¾d. oz., and **bismuth salicylate** in 1-cwt. lots is up 6d. to 20s. 3d. lb.

Among the general chemicals, **sodium sulphate** ex-works (Glauber salt) is up by £1 to £14 ton. **Mercurous chloride** is down 12s. 6d. to 53s. 6d. kg. **2:4-Dichlorophenoxyacetic acid** 99% pure in 1-cwt. bags is down £10 to £310 ton.

Palm kernel oil, refined, deodorised, in 2-ton lots, naked, ex-works, has dropped £3 to £109 ton.

Drugs—a £163 million industry

British drug and pharmaceutical production rose from £73 million in 1948 to £163 million in 1958. In the same period the number of persons employed rose from 48,600 to 58,000 (provisional).

These figures are given in the A.B.P.I. annual report 1960-61. In the ten years from 1948-58 exports increased from £15·8 million to £37·7 million and by 1960 had risen to £44·4 million. Since 1954, when they were at a peak of £9·6 million, drug imports have declined to £5·3 million (1960).

Hickson's acquisition

Hickson and Welch (Holdings) Ltd. has acquired by the issue in exchange of 125,000 fully paid ordinary shares of Hicksons the whole of the issued capital of Alvin, Morris and Co. (Timber) Ltd. of Leeds, Manchester and Sheffield, which company has been established for many years as plywood, plastics, fibre building boards and timber importers and distributors.

An important range of Hickson chemicals is used by the timber and building board industries.

Insecticide conference

The next residential conference on insecticides and fungicides to be organised by the Association of British Manufacturers of Agricultural Chemicals will be held at the Grand Hotel, Brighton, from November 6 to 9. Papers are invited. All enquiries to W. A. Williams, ABMAC, 86 Strand, London, W.C.2.

Centrifuge agents

Thomas Broadbent and Sons Ltd., of Huddersfield, have appointed Thomas and Carroll Pty. Ltd., chemical engineers, Ampol House, 792 Elizabeth Street, Melbourne C.1, Victoria, as representatives in Australia for the complete range of chemical centrifuges now in production.

Biologic extract preparations

Gale and Mount Ltd., London agents for the Dutch manufacturers N.V. Philips-Duphar, have now produced a new list of biologic preparations. These include various grades of pancreatin, liver extracts and posterior pituitary extracts. For pancreatin, prices range from 22s. 6d. to 57s. 6d. per kg., liver preparations 18s. 6d. to 140s. kg. and pituitary preparations 5s. 9d. per 1,000 I.U. or 67s. 7d. per litre (19 I.U./c.c.).

Further education staff college

Mr. W. J. Richards, director of the Royal Radar Establishment, Malvern, has been appointed the first director of the proposed new Staff College for Further Education by the governing body, set up by the Minister of Education last autumn under the chairmanship of Lord Fleck. Mr. Richards will take up his new appointment in July.

The College will be a wholly new departure in the British educational system. The aim is to create a national centre at which principals and other selected staff from colleges of technology and commerce can exchange ideas and experience with senior staff from industry, local and central government, the Universities and overseas and where they can jointly study the aims, ideas and the growth of education in the light of the rapid advances in science and technology.

The College is to be an independent self-governing institution and the governing body is widely representative of educational and industrial interests. The governors have at their disposal a capital fund of £100,000, contributed by industry, to meet the initial expenses of founding the College, and the Minister of Education has undertaken to contribute an annual grant towards the running expenses.

The College is to be entirely residential and a search is being made for suitable premises, preferably in the Midlands, around which the College can be developed.

I.C.I. to double polypropylene output

Within four months of the opening of its new 11,000-ton polypropylene plant at Wilton on the north-east Yorkshire coast I.C.I. has decided to build extensions doubling the output.

High-purity mercury

Johnson Matthey, following the installation of new equipment, are now able to offer in quantity two grades of mercury for laboratory and industrial use.

Redistilled mercury has a maximum impurity content of 5 p.p.m. (mostly copper and silver), and triple-distilled mercury a maximum of 1 p.p.m.

Approved names for drugs

The May supplementary list of approved names issued by the British Pharmacopœia Commission is as follows: all enquiries should be sent to the Commission at 44 Hallam Street, London, W.1.

Approved Name — *Other Names*

AMITRIPTYLINE
3 - (3 - Dimethylaminopropylidene) - 1 : 2 - 4 : 5-dibenzo*cyclo*hepta-1 : 4-diene
Tryptizol is the hydrochloride

CHLOPHEDIANOL
1 - *o* - Chlorophenyl - 3 - dimethylamino - 1 - phenylpropan-1-ol
Detigon is the hydrochloride

CHLORMEZANONE
2 - *p* - Chlorophenyltetrahydro - 3 - methyl - 1 : 3-thiazin-4-one 1 : 1-dioxide
Trancopal

CHLORQUINOL
A mixture of the chlorinated products of 8-hydroxyquinoline containing about 65 per cent of 5 : 7-dichloro-8-hydroxyquinoline
Quixalin

CYCLOPENTHIAZIDE
6 - Chloro - 3 : 4 - dihydro - 3 - *cyclo*pentylmethyl-7 - sulphamoylbenzo - 1 : 2 : 4 - thiadiazine 1 : 1-dioxide
Navidrex

CYPROHEPTADINE
1 - (2 : 2 - 5 : 6 - Dibenzo*cyclo*heptatrienylidene) - 4 - methylpiperidine
Periactin is the hydrochloride

DEXTROTHYROXINE
D - α - Amino - β - [4 - hydroxy - 3 : 5 - di - iodophenoxy) - 3 : 5 - di - iodophenyl] propionic acid
Choloxin is the sodium salt

EMYLCAMATE
1-Ethyl-1-methylpropyl carbamate
Striatran

ETHAMIVAN
NN-Diethylvanillamide
Vandid

ETHEBENECID
p-Diethylsulphamoylbenzoic acid
Urelim

HEXADIMETHRINE BROMIDE
Poly - (*NN'N'N'* - tetramethyl-*N*-trimethylenehexamethylenediammonium dibromide)
Polybrene

HOMOCHLORCYCLIZINE
1 - (*p* - Chlorobenzhydryl) - 4 - methylhomopiperazine

HYDRARGAPHEN
Phenylmercury 2 : 2' - dinaphthylmethane - 3 : 3'-disulphonate
Penotrane

INTERFERON
A protein formed by the interaction of animal cells with viruses capable of conferring on animal cells resistance to virus infection.

IOPHENDYLATE
Ethyl 10-*p*-iodophenylundecanoate
Ethiodan; Myodil

METHAMPHAZONE
4 - Amino - 6 - methyl - 2 - phenyl - 3 - pyridazone

METHYCLOTHIAZIDE
6 - Chloro - 3 - chloromethyl - 3 : 4 - dihydro - 2 - methyl - 7 - sulphamoylbenzo - 1 : 2 : 4 - thiadiazine 1 : 1-dioxide
Enduron

MORAZONE
2 : 3 - Dimethyl - 4 - (3 - methyl - 2 - phenylmorpholinomethyl) - 1-phenylpyrazol-5-one

NOXYTHIOLIN
N-Hydroxymethyl-*N'*-methylthiourea

PHENOXYPROPAZINE
(1-Methyl-2-phenoxyethyl)hydrazine
Drazine is the hydrogen maleate

PHENTERMINE
αα-Dimethylphenethylamine
Duromine (an ion-exchange resin complex)

PHENYLTOLOXAMINE
o-Benzylphenyl 2-dimethylaminoethyl ether

PIVAZIDE
N-Benzyl-*N'*-pivaloylhydrazine
Tersavid

POLYNOXYLIN
Poly[methylenedi(hydroxymethyl)urea]
Anaflex

PROPATYLNITRATE
1 : 1 : 1-Trisnitratomethylpropane
Etrynit; Gina

PSEUDOEPHEDRINE
(+) - 2 - Methylamino - 1 - phenylpropan - 1 - ol (a stereoisomer of ephedrine)

SORBIDE NITRATE
1 : 4-3 : 6-Dianhydrosorbitol dinitrate

VIPRYNIUM EMBONATE
6 - Dimethylamino - 2 - [2 - (2 : 5 - dimethyl - 1 - phenyl - 3 - pyrrolyl) vinyl] - 1 - methylquinolinium embonate (Embonic acid is adopted as the trivial name for 4: 4' - methylenebis - (3 - hydroxynaphthalene - 2 - carboxylic acid))
Vanquin

XANTHOCILLIN
Antibiotics obtained from the mycelium of *Penicillium notatum* (Xanthocillin X is 2 : 3 - Diisocyano - 1 : 4-di(*p*-hydroxyphenyl)buta-1 : 3-diene)

INDEX TO THE SUPPLEMENTARY LIST

Proprietary Name	*Approved Name*
Anaflex	Polynoxylin
Choloxin	Dextrothyroxine
Detigon	Chlophedianol
Drazine	Phenoxypropazine
Duromine	Phentermine
Enduron	Methyclothiazide
Ethiodan	Iophendylate
Etrynit	Propatylnitrate
Gina	Propatylnitrate
Myodil	Iophendylate
Navidrex	Cyclopenthiazide
Penotrane	Hydrargaphen
Periactin	Cyproheptadine
Polybrene	Hexadimethrine Bromide
Quixalin	Chlorquinol
Striatran	Emylcamate
Tersavid	Pivazide
Trancopal	Chlormezanone
Tryptizol	Amitriptyline
Urelim	Ethebenecid
Vandid	Ethamivan
Vanquin	Viprynium Embonate

Omissions from next B.P.C.

The Codex revision committee of the Pharmaceutical Society has issued the following list of monographs which it has been provisionally decided not to include in the B.P.C. 1963. Any comments on this list should be sent to the Editor, British Pharmaceutical Codex, 17 Bloomsbury Square, W.C.1, before August 1, 1961.

PART I. MONOGRAPHS

Allobarbitone
Volatile Bitter Almond Oil
Aminometradine
Amiphenazole Hydrochloride
Arrowroot
Benactyzine Hydrochloride
Siam Benzoin
Precipitated Bismuth
Bromoform
Caffeine Citrate
Rectified Camphor Oil
Carbon Tetrachloride
Cassia Fruit
Chenopodium Oil
Chlormerodrin
Chondrus
Creosote
Decamethonium Iodide
Dichloroxylenol
*Digitalis Lanata Leaf
Saccharated Ferrous Carbonate
Fuller's Earth
Geranium Oil
Hexamine
Hexobarbitone
Hexobarbitone Sodium
*Hydnocarpus Oil
Mandelic Acid
Meralluride
Mercurous Chloride
Mersalyl Sodium
Methylamphetamine
Morphine Tartrate
Pepsin
Phenylmercuric Acetate
Prune
Scarlet Red
Anhydrous Sodium Phosphate
Stearic Acid
Strychnine
Strychnine Sulphate
Sulphacetamide
Sulphamerazine Sodium
Suprarenal Cortex Injectin
Tamarind
Terebene
Trinitrophenol

* Deletion of these monographs is still under consideration.

PART VI. MONOGRAPHS

Capsules of Carbon Tetrachloride
Creosote
Ferrous Carbonate
Cassia Pulp
Confection of Senna
Effervescent Granules of Sodium Citro-tartrate
Emulsion of Cod-liver Oil
Enema of Magnesium Sulphate
Eye-drops of Cocaine and Mercuric Chloride, Oily
Eye Lotion of Adrenaline, Compound
Eye Ointment of Atropine with Mercuric Oxide
Gelatin of Zinc and Ichthammol
Glycerin of Borax
Honey of Borax
Infusion of Quassia, Concentrated
Rhubarb, Concentrated
Senna, Concentrated
Injection of Bismuth
Dapsone
Quinine and Urethane
Sodium Chloride, Compound
Strychnine
Irrigation of Zinc Sulphate
Lotion of Lead with Opium
Lozenges of Chinchocaine
Potassium Chlorate
Mixture of Senna, Compound
Mouth-wash of Formaldehyde
Ointment of Colophony
Ointment of Mercuric Nitrate Strong
Mercury, Compound
Ointment of Mercury, Dilute
Mercury, Strong
Oleated Mercury
Oleoresin of Capsicum
Paste of Resorcinol and Sulphur
Pills of Aloes and Nux Vomica
Ferrous Carbonate
Powder of Borax for Nasal Wash, Compound
Compound Effervescent Powder, Strong
Solution of Burnt Sugar
Ferrous Iodide
Iodine, Simple
Quinine, Ammoniated
Spirit of Camphor
*Surgical Spirit No. 2
Syrup of Ferrous Iodide
Senna
Tablets of Aloes and Nux Vomica
Aloin, Compound
Digitalis, Compound
Ferrous Carbonate
Ferrous Carbonate and Arsenic
Mercurous Chloride
Rhubarb and Sodium Bicarbonate
Rhubarb, Compound
Saccharin
Santonin
Tincture of Tolu
Vitrellae of Trichloroethylene
Chloroform Water, Concentrated
Spearmint Water, Concentrated

* Deletion of this monograph is still under consideration.

Sabin vaccine: Wellcome's and Pfizer's progress

The Wellcome Foundation Ltd. has become the first company in the world to offer oral polio vaccine on a regular commercial basis. The vaccine produced by The Foundation has been approved by the Ministry of Health for sale throughout the world.

The Wellcome Vaccine is of the type evolved by Dr. Sabin of Cincinatti and is prepared from strains provided by him. Supplies are held in reserve by the Ministry of Health for possible use in Great Britain.

Pfizer Ltd., expect their oral polio vaccine to be approved by the Ministry soon. The company is providing free to Japan almost a million doses of vaccine for field trials in a polio epidemic area. Over a million doses have also been sent free to the U.S. for field trials.

More tax-exempt drugs

Additions and extensions to the list of drugs exempt from purchase tax are made by a new Treasury order (S.I. 929).

The additions are:

HEAD II

Bromvaletone

2 : 4 - Diamino - 5 - (3 : 4 - dimethoxybenzyl)pyrimidine, whether or not mixed with sulphaquinoxaline

N,N - Dimethyl - N - 2 - phenoxyethyl-N - 2′ - thenylammonium p - chlorobenzenesulphonate, whether or not mixed with piperazine phosphate

HEAD III

4 - N - Benzylanilino - 1 - methylpiperidine and salts thereof

2-Chloro-4-nitrobenzamide

1 : 2-Dimethyl-5-nitroimidazole

Dimethyl 2 : 2 : 2 - trichlorohydroxyethylphosphonate

Methaqualone, and salts thereof

2-B-Methoxyethylpyridine

Phenelzine, and salts thereof

Primaquine, and salts thereof

Propylhexedrine, and salts thereof

o - Salicylamide 2 - ethoxyethyl ether, whether or not mixed with phenacetin

The existing entries in Head III for "Aminoacridine flavines" and "Phenothiazine and mixtures thereof" have been extended by the words italicised as follows:

Aminoacridine flavines *whether or not mixed with 8-hydroxyquinoline and gamma benzene hexachloride*

Phenothiazine and mixtures thereof with one or more of the following substances, that is to say, *hexachlorophene*, lead arsenate, *organo-phosphorus compounds* and the sulphates of cobalt, of copper, of iron and of manganese.

The entry for

"The molecular compound of chloral hydrate and phenazone"

is transferred from Head II to Head III.

Definition of drugs

A review of the principles governing the prescribing of borderline drugs and medicines has been carried out by the Standing Joint Committee on the Classification of Proprietary Preparations, under the chairmanship of Lord Cohen of Birkenhead. The Committee was authorised to do so by the Central and Scottish Health Services Councils, and their report* was published last month.

This review replaces the three reports made by the Definition of Drugs Joint Sub-Committee of the Standing Medical and Pharmaceutical Advisory Committees in England and Wales and the Medical, Pharmaceutical and General Practitioner Advisory Committees in Scotland.

A copy of the report is being included in the comprehensive handbook on prescribing which, on the recommendation of the Hinchliffe Committee on the Cost of Prescribing, is being issued for the personal use of all doctors—both in general practice and in hospitals—taking part in the National Health Service. This handbook was scheduled to be in the hands of every doctor by the end of April.

* Report on Definition of Drugs. H.M.S.O. 6d., net.

THE TECHNICAL PRESS IN JUNE

Modern Valves for Industry

A SPECIAL feature on valves is published in **Chemical and Process Engineering** containing two articles, "Recent Trends in Valve Design" and "Control Valves." Also included is an article on the uses of mild steel in the construction of chemical plant and a review of gas cleaning and scrubbing plant.

Fibres and Plastics reports on the latest advances in dyes and dyeing equipment. This report includes an article on the manufacture and dyeing of polyamide fibres. In another article the uses of cellular foams in clothing applications are discussed.

Three interesting articles on instrumentation appear in **Petroleum:** "Level Measurement in Deep Storage," "Instrumentation of Blending Circuits," and the third is a review of current developments in instrumentation and control in the petroleum industry.

Paint Manufacture includes articles on the design of paint-making machines, magnetic printing inks and fluorescent paints.

Hydraulic control circuits are discussed in an article in **Automation Progress.** There are also features dealing with stock control in the motor-car industry, the control of a town's gas supply by an unmanned station, and the future evolution of automation.

World Crops carries a special review on spraying machinery and pesticide chemicals. Articles include: "Progress in Weed Control in Malaya," "Progress in Crop Protection" and "Cotton Spraying in Sudan."

An article of interest to chemists appears in **Dairy Engineering**. This is "Protein Testing in the Netherlands."

Food Manufacture publishes a review of various types of refrigeration plant used in the industry. The factory visit described this month is to Trufoods Ltd.

A preview of the International Construction Equipment Exhibition appears in **Public Works and Muck Shifter**. There is also an interesting article describing the engineering works required to mine underwater sulphur deposits.

Articles in **Corrosion Technology** include "Zinc Dust Paints—Chemical or Electrochemical Protection ?", "Vacuum Coatings—Present and Future Techniques," and "The Effects of Fouling and Its Economic Importance."

Chemical consultancy enlarged

The practice of J. A. Radley Industrial Research and Development Laboratories has been registered as a limited company under the title of J. A. Radley (Laboratories) Ltd. The laboratories have recently been extended and stores, pilot-plant, library and other extensions have been added. Analytical, technological and developmental services will continue, together with sponsored and pure research work. The permanent board of governors of the Research Institute consists of J. A. Radley and J. S. Stanley. Co-opted governors for purposes of consultation include: Prof. H. V. A. Briscoe, Prof. F. C. Frank, Dr. C. H. Giles, Dr. P. F. Holt, Prof. A. J. Kennedy, Dr. A. C. Riddiford and Dr. W. Whelan.

Company finance

Boots Pure Drug Co. Ltd. Group profits before tax for the year ending March 31, 1961, were £8,826,093 (£7,560,697). Net profit after all charges including tax was £3,396,660 (£3,148,027). In November there was a scrip issue to ordinary shareholders of one for one. Interim dividend was paid on the old capital of 8% equivalent to 4% on the share capital as increased by the scrip issue. Final dividend of 8% thus makes a total of 12% on the new capital (10½%).

Beecham Group. Total sales for the year to March 31, 1961 were £56,344,000 (£49,959,000) and the profits after tax were £4,143,000 (£3,806,000). A final dividend of 14% making 30% for the year (27%) was recommended.

MEETINGS

Society for Analytical Chemistry

June 21. London discussion meeting. 6.30 p.m. The Feathers, Tudor Street, London, E.C.4.

Faraday Society

June 27. Colloid Centenary Symposium. Royal College of Science and Technology, Glasgow, C.1. Speakers include: Sir Eric Rideal, Prof. J. A. V. Butler, Dr. A. S. C. Lawrence, Dr. A. P. Prosser.

Society of Chemical Industry

June 23. Pesticides Group. Visit to Glasshouse Crops Research Institute, Littlehampton, Sussex.

Society for Applied Bacteriology

July 11-13. Summer Conference. Wye College, Kent. Symposium on Bacteria of the Intestine.

News from Abroad

EIRE

Sulphuric acid manufacture

Irish, Belgian and Canadian interests are to build a £2m. plant near New Ross to manufacture 115,000 tons of sulphuric acid a year. Pyrites will be obtained from the St. Patrick copper mines at Avoca. A large part of the plant's output of superphosphates and compound fertilisers, to be produced with the aid of imported phosphate rock and ammonia, has been earmarked for export.

UNITED STATES

Flavours firm acquired

International Flavors and Fragrances Inc. recently acquired Kerr Fruit Concentrates Inc. at Portland, Oregon. Kerr, which has been a family concern since 1900, produces concentrated fruit and berry juices for the food industries. This latest acquisition will enable I.F.F. to develop and market a wider range of concentrates and essences based on the natural juices.

75,000 new chemicals

A record-breaking total of 75,000 new chemical compounds was reported by the world's chemists in 1960.

Approximately one-quarter of the new chemicals, 19,000, were made by American scientists. Chemists in Communist countries reported approximately 9,000 new chemicals, while the Japanese accounted for almost 7,000 compounds.

The first cumulative index of the *Index Chemicus* published by the Institute for Scientific Information, 33 South Seventeen Street, Philadelphia, Pa., marks the first time that this information has been reported so promptly. The *Index* was prepared by electronic computing equipment in record-breaking time.

SUDAN

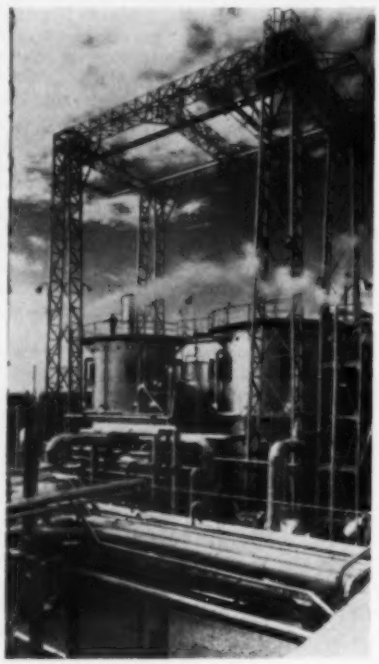
Soap factory project

Equipment and machinery for the construction of a soap factory is reported by Barclays Bank D.C.O. to have arrived in Sudan from Italy. The cost of building the factory, which will be in Khartoum, is estimated at £S500,000.

SPAIN

Chemical plant proposed

W. R. Grace and Co., a U.S. firm, is waiting for a Spanish government decision on its proposal to erect a chemical plant on the Mediterranean coast. The subsidiary company, to be known as Darex Española, will manufacture synthetic rubber, synthetic catalysts, plastic film and fertilisers.



AMMONIA PLANT

High-pressure gas reform furnaces designed by Chemico (New York) for the ONIA ammonia plant which recently went on stream in Southern France. These gas reformers operate at 250 p.s.i.g., the highest pressures yet obtained, according to Chemico, and this new design eliminates the necessity of one of the numerous compression stages normally required in such a plant. Improved heat recovery in the combined gas reform and CO_2 removal system is claimed, allowing heat to be transferred to the rest of the plant. In the carbonate CO_2 removal section, absorption pressures are regulated to allow new levels of regeneration efficiency.

SWITZERLAND

Aerosol Congress and Exhibition

The third International Congress organised by the Federation of European Aerosol Associations under the auspices of the International Aerosol Association will be held from October 4-6, 1961, in the Congress House, Lucerne, Switzerland. Papers will be presented covering scientific, technical and commercial aspects of the aerosol field. A new innovation this year will be an aerosol packing contest, organised by F.E.A.

The first International Aerosol Exhibition will be held during the period of the congress but will cover two extra days, running from October 4-8, 1961. The exhibition will be housed in the Kurst-und Kongresshaus, Lucerne.

Cyanamid's new research laboratory

The Cyanamid European Research Institute, a new laboratory devoted entirely to basic research, has been opened in Geneva.

The facilities and equipment of the Institute cost $1,700,000.

The research programme includes theoretical organic chemistry, high polymers, inorganic chemistry, and solid state physics. Among the first group directors to be appointed are Drs. Robert F. Hudson (theoretical organic chemistry) and Edwin A. C. Lucken (instrumentation group and physical chemistry) of Great Britain, Dr. A. C. Klixbüll-Jorgensen (theoretical inorganic chemistry) of Denmark, Dr. Emanuel Mooser (solid state physics) of Switzerland and Dr. Erwin Weiss (synthetic inorganic chemistry) of Germany.

The Institute is at Cologny overlooking Lake Geneva and has about 25,000 sq. ft. of laboratory and office space. The total scientific and administrative staff will number 50 to 60 people.

BELGIUM

Fisons' common market project

Fisons Fertilisers Ltd. have formed a new fertiliser manufacturing company in association with Union Chimique Belge of Brussels. Known as Fison U.C.B. S.A., the company will produce high analysis granular compound fertilisers for the Belgian domestic market and for neighbouring Common Market countries. A manufacturing plant is to be built at Zandvoorde, near Ostend, and production is planned to start in the summer of 1962. In addition to selling in Belgium and other Common Market countries, Fison U.C.B. will export fertilisers to overseas territories.

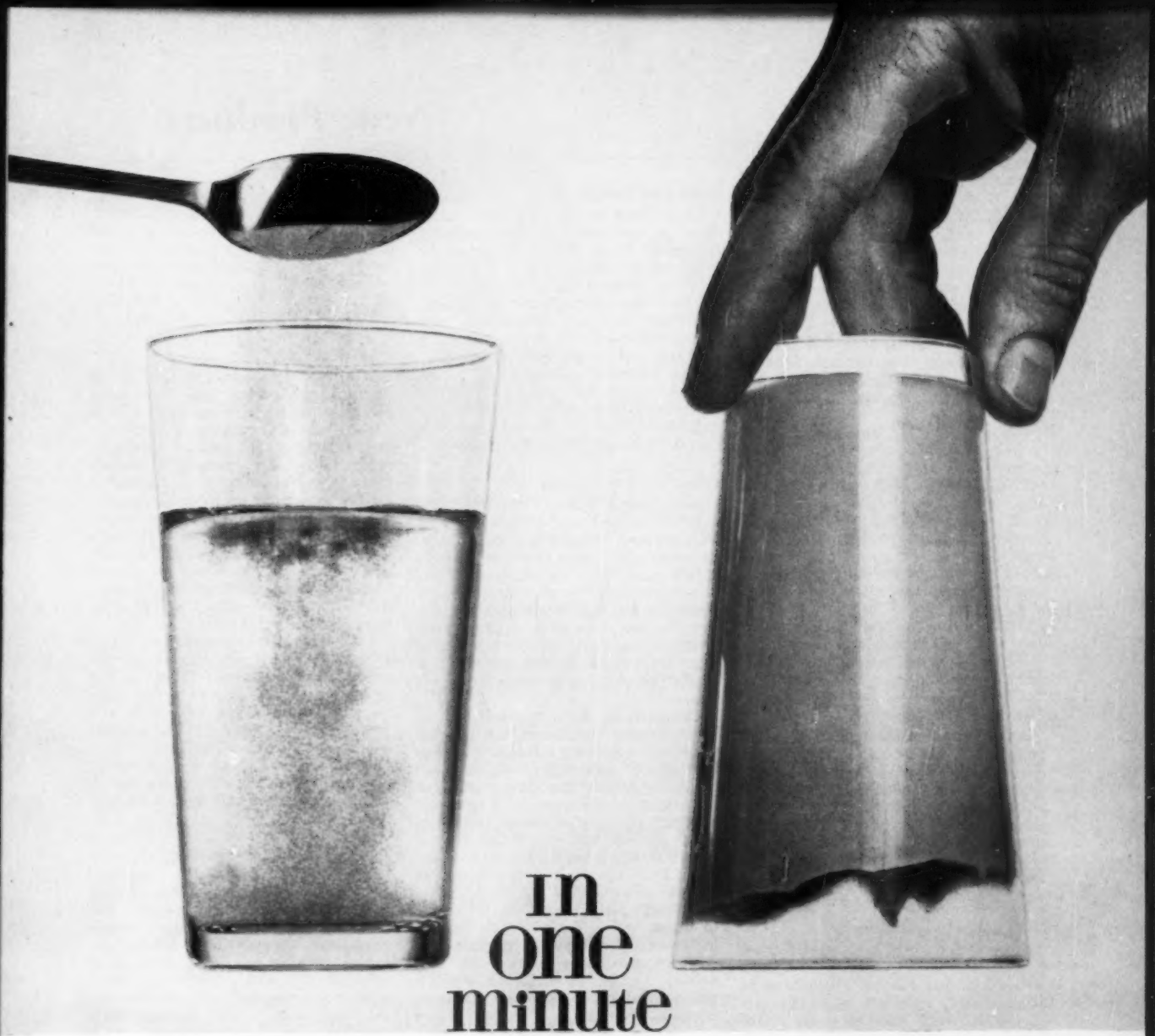
The fertiliser plant will be one of the most advanced in Europe, initially capable of a production rate of 20 tons per hour, and using a new production process under development now by Fisons Fertilisers Ltd.

Fison U.C.B.'s factory site at Zandvoorde will be within the present U.C.B. factory boundary and U.C.B. will supply the new company with nitrogenous material and phosphoric acid. Fisons Fertilisers Ltd. will make available their full technical and research facilities on fertiliser manufacture to the new company.

THAILAND

New pharmaceutical plant

The representatives of the Italian firm Lepetit of Milan and the Thai Minister for Industry recently signed an agreement in Bangkok for the establishment in Thailand of a pharmaceutical plant.



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INDIA

Drug industry expansion

Last year drugs valued at £65,250,000 were manufactured in the country and of this the imported components formed only £6,750,000. There are now more than 2,100 small-scale drug manufacturers and 97 large-scale units in India. The Government has stated that it is prepared to spend more than £412,500 a year to develop co-operative research in the industry.

Russians set up drug plants

An antibiotics plant costing £675,000 was inaugurated in Baroda recently by the Home Minister, Mr. Lal Bahadur Shastri.

He said that a number of drug projects were being set up with Soviet technical assistance. These included an antibiotic plant at Rishikesh, a synthetic drugs plant at Hyderabad, a chemical plant in Kerala State and a surgical instruments plant at Madras. These were likely to go into production in about three years' time. The Minister said that a corporation was being set up with an authorised capital of about £11·25 million to run various drug units to be established with Soviet aid.

He also said that a penicillin factory was to be started soon in Calcutta.

New fertiliser plants

A £20·7m. fertiliser plant is to be built at Trombay near Bombay by Hindustan Chemicals and Fertilisers, a state-owned company. It is also reported that a private plant, with an initial annual capacity of 40,000 tons of superphosphates and 16,500 tons of sulphuric acid, will be erected in Madras State.

AUSTRALIA

New Laporte company

Laporte Industries Ltd., have formed Laporte Titanium (Australia) Pty. Ltd., which is to manufacture titanium oxide at Bunbury, Western Australia. A £3½m. (£A4m.) plant is to be established. The chairman of the new company is Mr. Robert I. Ainslie, Q.C., partner in the firm of Stone, James and Co., solicitors and notaries, of Perth.

ISRAEL

Citric acid plant

In Haifa Bay, a $2 million dollar citric acid plant will be built by Miles Chemical Co., of Elkhart, Indiana, U.S.A. It is expected to be ready for operation by the autumn this year. Annual capacity will be 1,500 tons of citric acid, 50% of which is expected to be exported. Israeli technicians will be trained in Elkhart.

The plant will utilise the Miles deep fermentation process whereby air is blown through large tanks in which the mould grows on sugar solution, similar to the submerged fermentation process used for antibiotic production.

Improved Teepol

Shell Chemical Co. Ltd. have introduced a new grade of their synthetic detergent, *Teepol*. It is claimed to be 50% more efficient than the older product. There is no increase in price.

New white, red and black 4- and 1-gal. containers have been introduced. As before, the 4-gal. tin has a measuring dispenser and the smaller tin a pourer.

The increased efficiency of "New Teepol" means that one 4-gal. can will clean 60,000 dirty plates; over 900 travel-stained vehicles; 225,000 sq. ft. of dirty floor or 90,000 sq. ft. of grubby paintwork.

Filter for sun creams

Aktiebolaget Bofors Nobelkrut have now commenced production of glyceryl *p*-amino benzoate on a pilot plant scale. This material is used extensively in the U.S.A. as a filter for ultraviolet light in sun protective preparations. Besides absorbing the skin-irritating ultraviolet rays, a sun screening agent should transmit that part of the ultraviolet spectrum, causing no skin irritation but giving rise to pigment formation of the skin.

Comparative tests, carried out in Bofors Research Laboratories, with other ultraviolet absorbing substances showed that glyceryl *p*-aminobenzoate possessed the best ultraviolet absorbing capacity in the region of the ultraviolet spectrum causing skin irritations (2,900 Å-3,200 Å). It was also found that it absorbed only a small part of the ultraviolet light causing pigment formation without skin irritation (73,200 Å).

Glyceryl *p*-aminobenzoate is soluble in water and is most suitable for use in cream or emulsion preparations. Samples are available from the Sole Selling Agents in the U.K.—Guest Industrials Ltd., 81 Gracechurch Street, London, E.C.3.

Aerosol nail conditioner

Hard'n Fast, a new cosmetic product which claims to harden nail varnish, prevent chipping, add brilliance, and to condition and soften cuticles comes in 6-oz. tinplate aerosol containers manufactured by the Metal Box Co., price 12s.

The pack, which is decorated using a three-colour label, has white ends at both top and bottom and is fitted with a Metal Box standard precision valve.

Clover killer

A new weedkiller, *Clovotox*, made by May and Baker Ltd., is claimed to kill clover without harming the grass. At the same time it will control suckling clover, birdsfoot trefoil and pearlwort, normally all resistant weeds. Care must be taken that the compound does not drift to flower beds.

It should be used between April and September; it is particularly effective when used two or three weeks after the lawn has been given a dressing of fertiliser. Four tablespoons of concentrate are added to 1 gal. of water and the clover patches are soaked. A 4 fl. oz. tin treats 110 sq. yd. of turf and retails at 4s.

Appetite limiter

William R. Warner, and Co. Ltd. of Eastleigh, Hampshire, have introduced *Lucofen tablets*, a new compound which is claimed to be pharmacologically different from all other anorectics. *Lucofen* is recommended for overweight of any ætiology, degree and age group, including obesity associated with cardiovascular disease or pregnancy, and it acts without interfering with normal eating pleasure. Weight loss is gradual, safe and dependable because *Lucofen* causes no cortical stimulation and therefore ensures freedom from restlessness, sleeplessness, habituation or addiction.

Each *Lucofen* tablet contains 25 mg. 1-(*p*-chlorophenyl)-2-methyl-2 aminopropane hydrochloride. Dosage is one tablet three times a day before each meal. Bottles of 50 and 500 cost 7s. and 57s. respectively (trade). The product is subject to Purchase Tax.

Lucofen is not subject to legal restriction, but the manufacturers say that it should be supplied only against doctors' prescriptions.

Bottle-washing compound

The latest bottle-washing compound to be developed by the Diversey-Deosan Research Laboratories is *Bril-tak*. The chelating action of this high caustic compound, which is due to sodium gluconate, holds in solution many types of contamination and prevents them from being re-deposited on bottles and machine parts. The manufacturers claim excellent label removal. It is stated that *Bril-tak* has a built-in foam control, preventing excessive foaming and consequent loss of cleaning and rinsing efficiency; loss of solution owing to overflow is also prevented.

Non-barbiturate sedative

The Distillers Co. (Biochemicals) Ltd. have made their non-barbiturate sedative and hypnotic *Distaval* available in a liquid form. The product, *Distaval* Suspension, contains 50 mg. thalidomide in each 5 ml. teaspoonful.

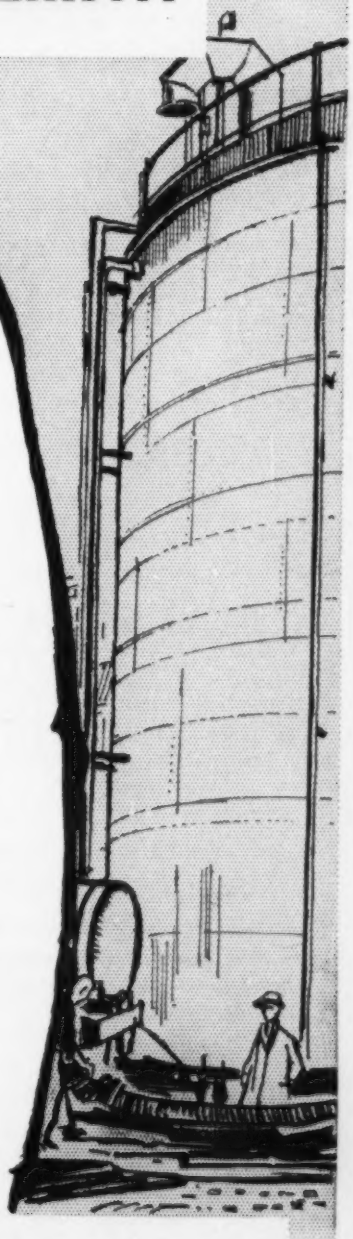
Distaval is claimed to be as effective as barbiturates, yet free from the side-effects associated with their use.

The pack and price is as follows: bottle of 60 ml. (approx. 2 fl. oz.), 3s. trade price; retail 4s. 6d. Ex. P.T.

The product is supplied upon prescription only.



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NEW TRADE MARKS

APPLICATIONS

Cosmetics and toilet preparations

OUTDOOR GIRL.—792,136. *Crystal Products Co. Ltd.*

DIS.—804,895. *Technichem (Winton) Ltd.*

ELOPEMENT.—812,407. *Roberts Windsor Ltd.*

PINK MIST.—813,482. *Co-operative Wholesale Society Ltd.*

VERYL.—813,830. *County Laboratories Ltd.*

PRIMAWELL.—815,924. *Wella Rapid Ltd.*

CARAVEL.—806,722. *Innoxa (England) Ltd.*

VITOLAN.—813,010. *Rosedale (Products) Ltd.*

ISOLA BELLA.—B813,402. *Cussons Sons and Co. Ltd.*

LOVE-LITE.—813,484. *Ashe Laboratories Ltd.*

BANDBOX SPRAY-TINT.—813,485. *Ashe Laboratories Ltd.*

VASSAR.—B813,829. *County Laboratories Ltd.*

GUARDSHINE.—B816,192. *Reckitt, Colman, Chiswick (Overseas) Ltd.*

KIROLIN.—816,640. *Preemo and Silks Toilet Co. Ltd.*

WHISPER.—816,781. *Thomas Hedley and Co. Ltd.*

Pharmaceuticals

TRYPTANOL.—810,916. *Merck and Co. Inc.*

SINOVUL.—811,560. *Løvens Kemiske Fabriks Handelsaktieselskab.*

VIBACON.—812,808. *Keith Jenkins.*

QUIP.—813,082. *Aksjeselskapet Freia.*

BABYCHAM.—813,474. *Showerings Ltd.*

BIOSUXON.—813,547. *Biorex Laboratories Ltd.*

NAEMINAL.—814,656. *Thomas Kerfoot and Co. Ltd.*

ANFERGEN.—815,116. *Aktiebolaget Astra, Apotekarnes Kemiska Fabriker.*

VITAQUID.—815,429. *Roche Products Ltd.*

INVESTAPLAQ.—815,741., NIGHTSED.—815,743, PRIMAPLAQ.—815,746. *Winthrop Group Ltd.*

EXPANSYL.—816,016. *Smith, Kline and French Laboratories Ltd.*

NEW PATENTS

COMPLETE SPECIFICATIONS ACCEPTED

Miscellaneous

Process for the production of dimethyl terephthalate by catalytic oxidation of *p*-xylene and an apparatus for carrying out the process. *A. Majrich.* 862,391.

Process for the manufacture of halogen substituted aromatic nitrils. *Shell Research Ltd.* 861,899.

Process for preparing 3-acylamino-2-oxazolidones. *B. Hellinghuizer-Gerriesen.* 862,207.

Isoquinoline derivates and salts thereof and a process for the manufacture of same. *F. Hoffmann-La Roche and Co.* 862,052.

Method for the preparation of hydrazine derivatives of phosphoric and thiophosphoric acids. *J. A. Benckiser G.m.b.H.* 862,396.

Process for the production of dihydro-m-thiazines—4—3, 4". *Leuna-Werke W. Ulbricht Veb.* 862,368.

1 : 4 - dioxy - 5 - acylaminoanthraquinones and process for their manufacture. *Ciba Ltd.* 862,234.

Production of substituted tetrahydro-1, 4-oxazines. *A. Boehringer, E. Boehringer, I. Liebrecht, J. Liebrecht, and W. Mayer-List* [trading as *C. H. Boehringer Sohn*]. 862,198.

Reserpic acid derivatives and process for their manufacture. *Ciba Ltd.* 862,390.

Chemical compounds. *E. I. Du Pont de Nemours and Co.*, 861,951.

S-substituted hydantoins and their preparation. *Spencer Chemical Co.* 862,194.

Derivatives of 2-hydroxy-3-naphthanilide. *Imperial Chemical Industries Ltd.* 862,127.

Hydroxyalkyl-piperidines. *Ciba Ltd.* 861,815.

Addition product of tetracycline and process for its manufacture. *Farbwerke Hoechst A.G.* 862,124.

Process for preparing organic dithiophosphates. *C. Pfizer and Co. Inc.* 862,123.

Compositions capable of hardening throughout at room temperature and containing condensation products of LB-unsaturated compounds with methylol-aminotriazine allyl ethers. *Ciba Ltd.* 861,852.

2 : 5 - dimethanesulphon - oxyhexane. *National Research Development Corporation.* 861,818.

N-alkanoyl dinitrobenzamides. *Dow Chemical Co.* 861,890.

NEW COMPANIES

These particulars of new companies have been extracted from the daily register of Jordan and Sons Ltd., company registration agents, Chancery Lane London, W.C.2.

Quadralene Chemical Products Ltd. 28.2.61. 94 Liversage Street, Derby. £100. Dirs.: F. V. Smith-Neal, Harold and John Walker, N. W. Vale.

N. C. Bryant Ltd. 3.3.61. 22 Frederick Street, Sunderland. Chemists. £1,000. Dirs.: Noel C. and Mrs. S. C. Bryant.

R. G. Potts Ltd. 1.3.61. 14 Stonegate Road, Leeds 6. Chemists. £2,000. Dirs.: Mrs. E. Potts and J. R. T. Bangs.

Highgate Pharmacy Ltd. 28.3.61. 85 Highgate Road, London, N.W.5. To take over bus. of chemists cd. on by A. A. and Dorothy K. Coles. £500. Dirs.: Arthur A. and Dorothy K. Coles.

Ontap (Pharmacy) Ltd. 29.3.61. Argyle House, 29/31 Euston Road, London, N.W.1. £100. Dirs.: John Ongley and John Tappenden.

Dallen Chemists Ltd. 4.4.61. 20 Shepherds Bush Road, London, W.6. £1,000. Dirs.: Anne C. Allen and Thomas M. Dillon.

Shepherds Chemists Ltd. 27.3.61. 43 Wood Street, Northampton. Chemists, druggists. £200. Dirs.: George and Mrs. V. M. Shepherd.

F. P. Jones Ltd. 13.3.61. 5 Kingsbury Square, Aylesbury, Bucks. Manufacturing chemists. £100. Dirs.: Emrys and Olive A. P. Jones.

A. W. Hiddleston (Chemist) Ltd. 13.3.61. 53 Broad Park Road, Henley Green, Coventry. £2,000. Dir.: Alfred W. Hiddleston.

Vaughan Chemists (Hemel) Ltd. 14.3.61. 31 Stoneycroft, Hemel Hempstead. £100. To take over bus. of retail chemists cd. on at Hemel Hempstead. Dirs.: Leslie A. and Betty M. Vaughan.

Featherstone Drug Co. Ltd. 16.3.61. 10 Butts Court, Leeds 1. £1,000. Dir.: Sylvia Freeman.

Meeson Laboratories Ltd. 16.3.61. 151 Sunbridge Road, Bradford. Wholesale mnfrs. of pharmaceutical goods. £22,000. Dirs.: Frank and Mrs. M. I. Meeson.

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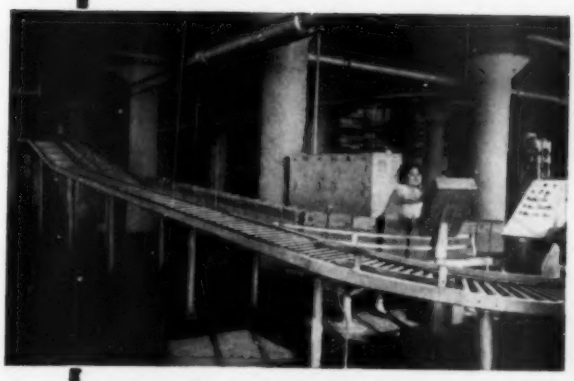
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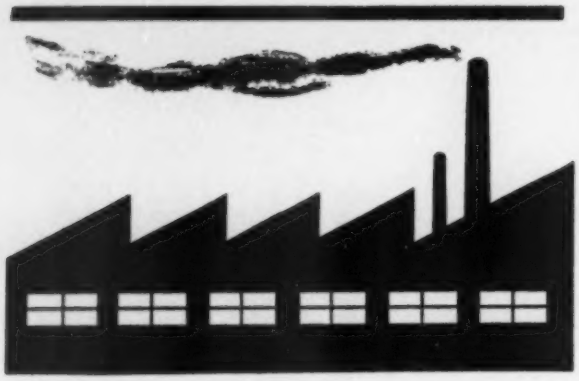
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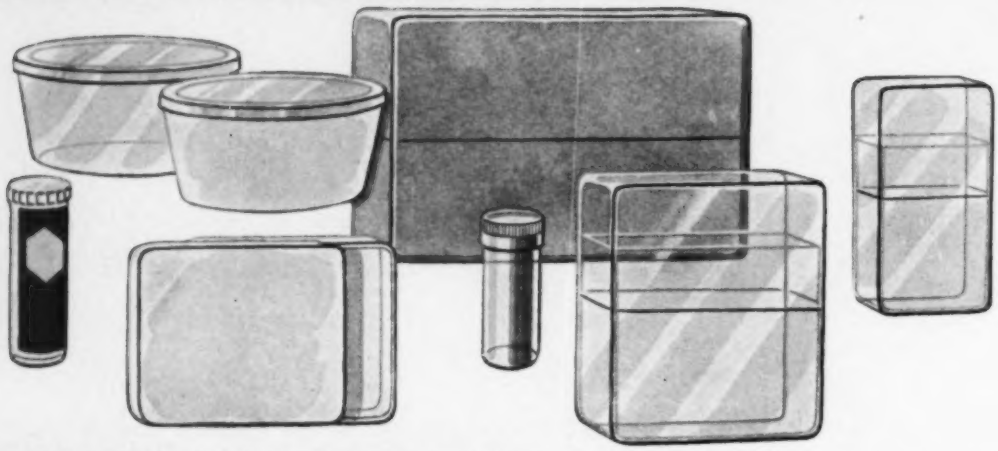
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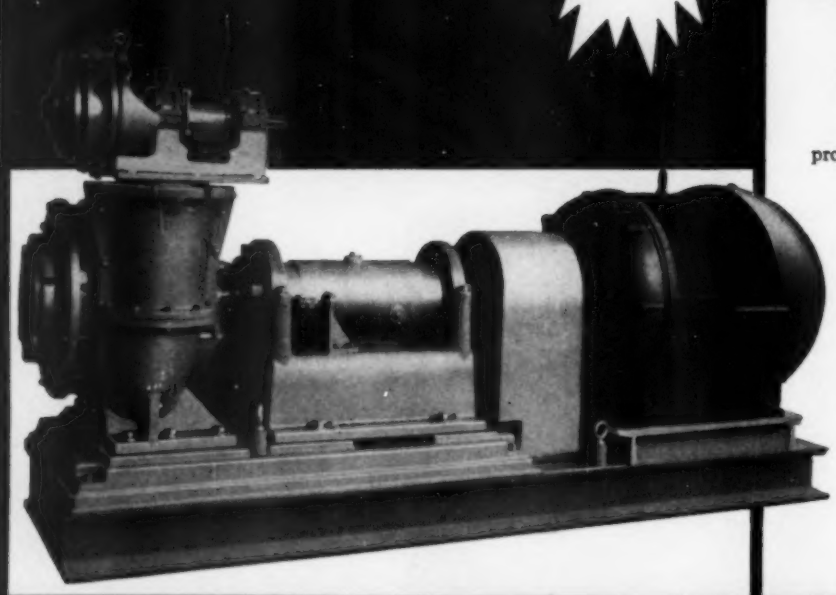
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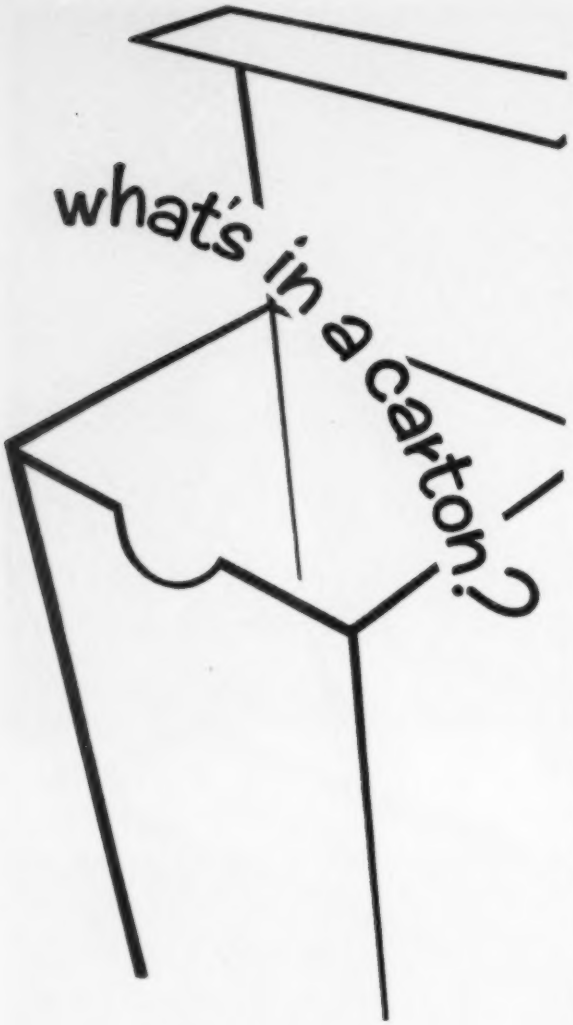
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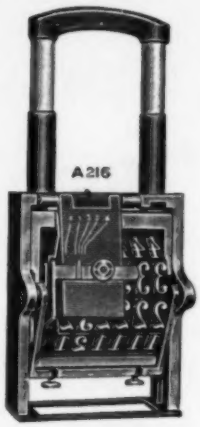
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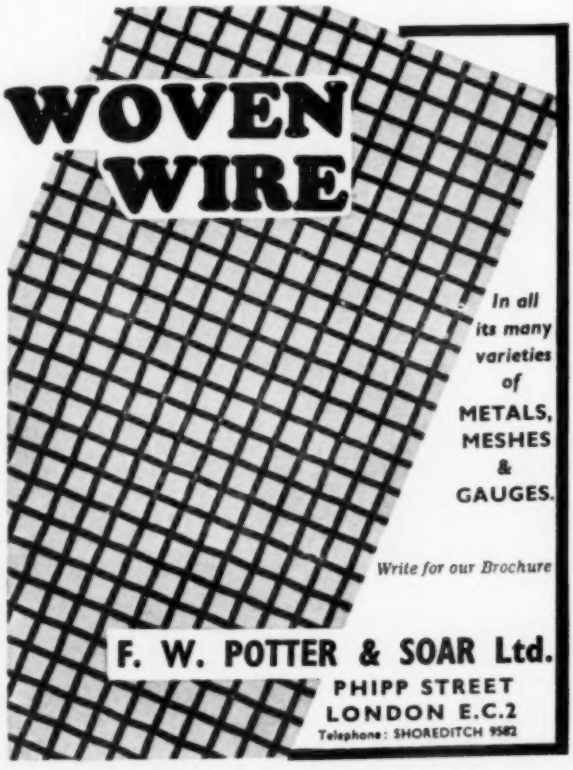
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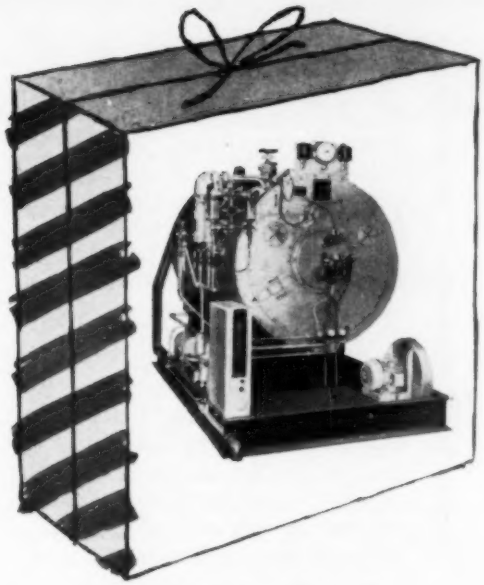
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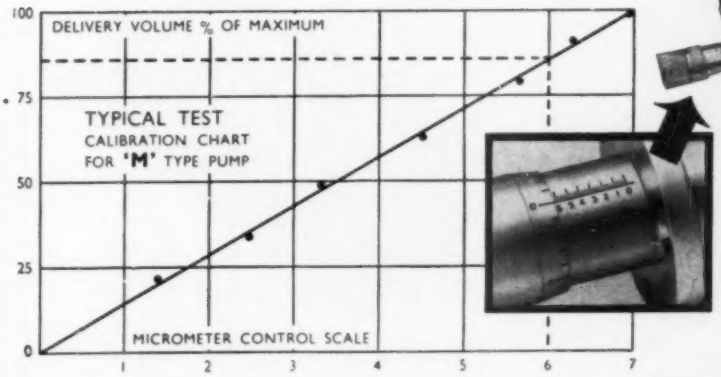
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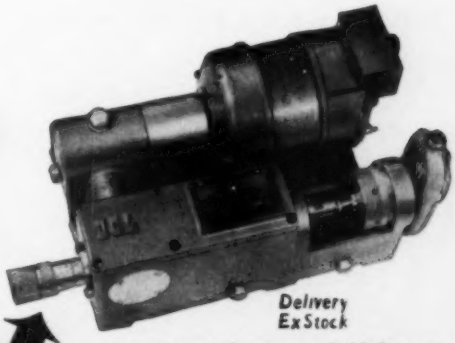
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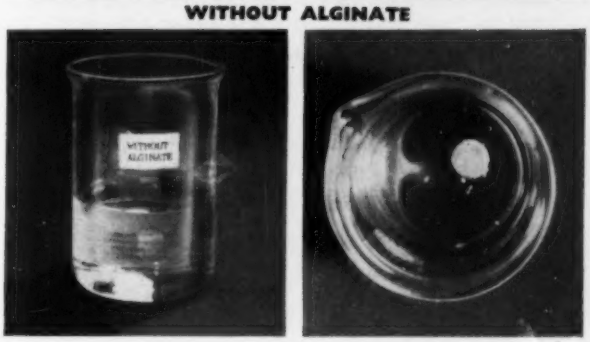
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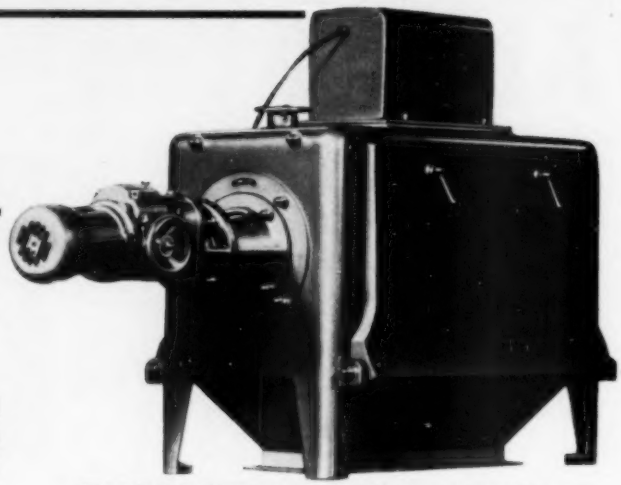
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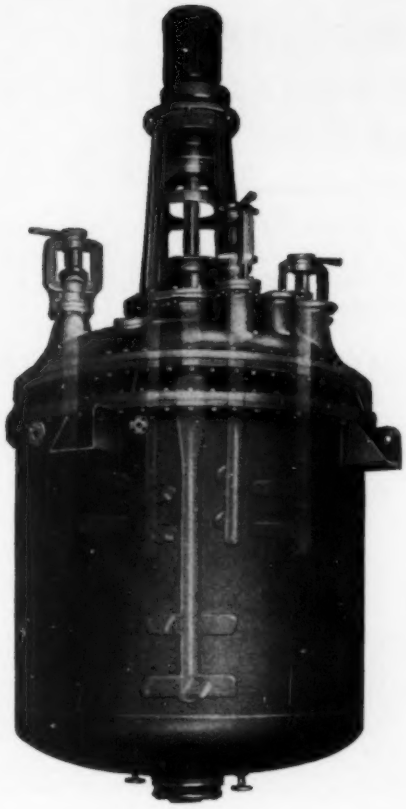
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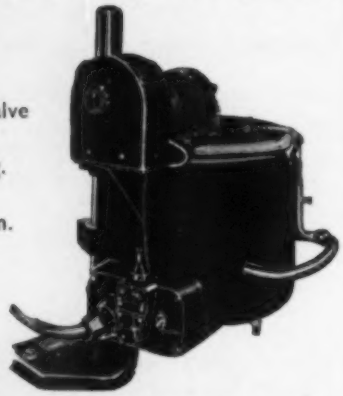
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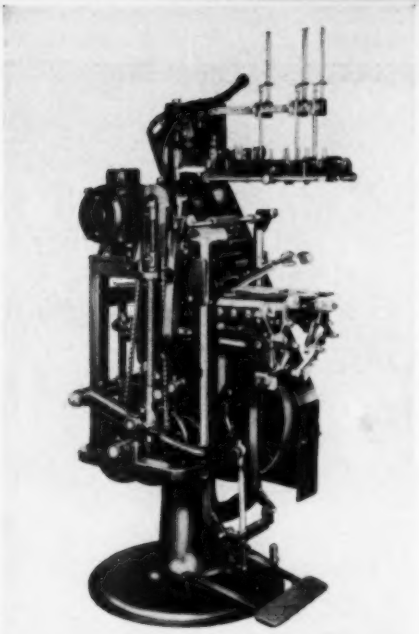
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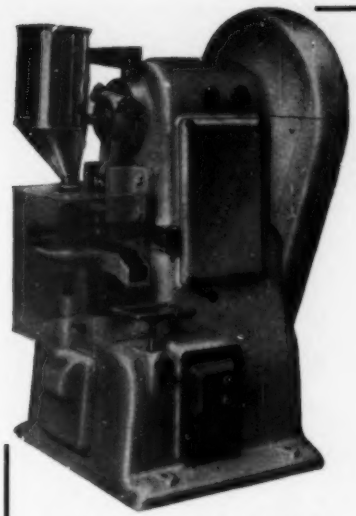
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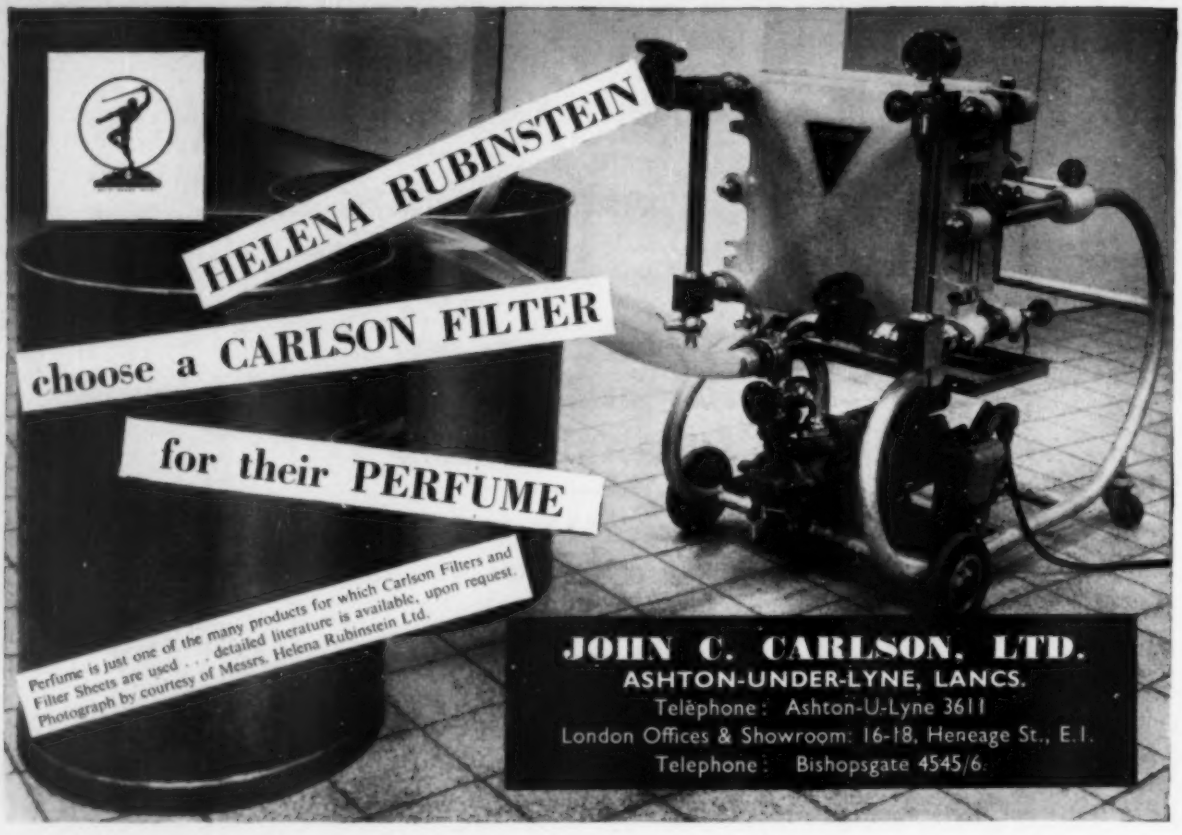
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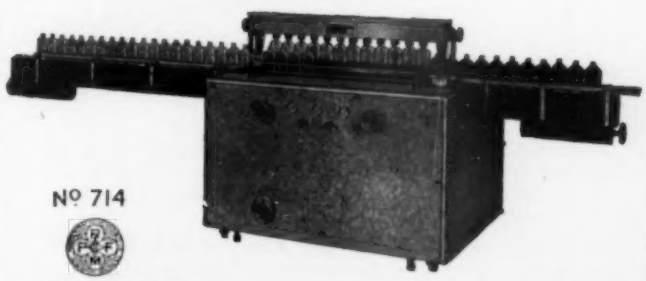
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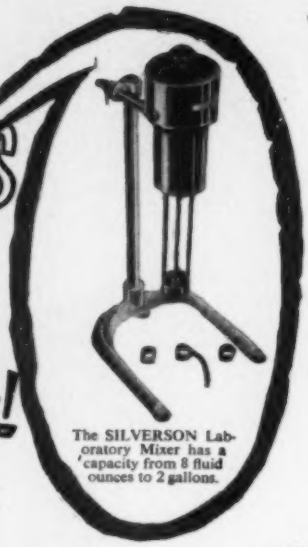
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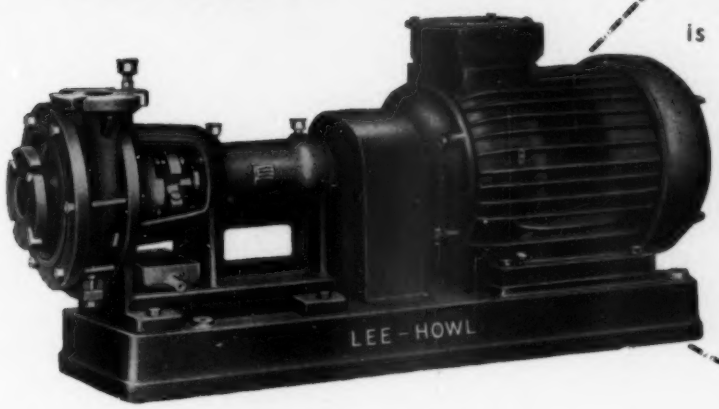
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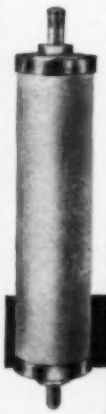
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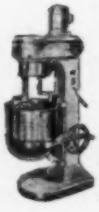
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All introductions are made on the understanding that should an engagement result the employer agrees to I.S.I.S. Appointments Register's terms, which are as follows:

For each person engaged the equivalent of two weeks salary payable by the employer within fourteen days of the date of engagement.

Signature..... Date.....

I.S.I.S. APPOINTMENTS REGISTER *(Continued from overleaf)*

present Design & Devpt. D/man, asbestos, rubber & glass mnfrs. Seeks post as **DESIGN OR DEVPT. ENGR. (MECH.) OR AS P.A. TO SENR. ENGR.** in research or devpt. Sussex or Hampshire. £1,050 p.a.

Ref. B.263. British. Male. Married. Age 42. 6 yrs. Apprencie Engr., trawler owners. At present Chief E.R.A., R.N., responsible training of Junr. E.R.A.'s & Mechanics. Seeks post as **PLANT/POWER/MAINTENANCE OR CHIEF ENGR.** U.K.—not London—Jamaica, Malaya or Nigeria. £1,200 p.a.

Ref. B.264. British. Male. Single. Age 25. Civil Serivce Cert. Maths. & Physics. A.M.S.I.T. 5 yrs. Instrumentation Engr., aerodynamic research. At present Projects Engr. (Systems), automatic data systems, design & instlln. Exper. digital data handling, digital computing with punched cards & tape & use of DC/AC servo chart recorders. Author of Specialised published articles. Seeks post as **INSTRUMENTATION/SYSTEMS ENGR.** Anywhere. £1,200 p.a.

Ref. B.266. British. Male. Married. Age 31. O.N.C. (Mech., Prod. & Marine), Grad.I.E.D. 4 yrs. Apprentice, petrol & oil pump & measuring equipt. 1 yr. D/man, oil company. At present D/man, air conditioning, heating & industl. paint finishing. Outside exper. on plant instlln. & testing. Seeks **ANY INTERESTING POST WITH PROSPECTS—BUT NOT D/MAN.** U.K.—London or S. England pref. £1,000 p.a.

Ref. B.267. British. Male. Married. Age 36. B.O.T. (Part A) 2nd Class Cert. 4 yrs. Apprentice Marine Engr., ship owners & repairers. 6 yrs. Junr./2nd Eng. Officer, ship owners. 2½ yrs. Plant Engr., electro-mech. engrs. 7 yrs. Chief Engr., food mnfrs. At present Chief Engr., food mfrs. Seeks post as **LIAISON ENGR.**, London or S.E. England. £1,250/£1,500 p.a.

Ref. B.268. British. Male. Married. Age 31. H.E.T., O.N.C. (Mech). 3 yrs. Toolmaker, aircraft. 2 yrs. Design D/man, contract design office. 2½ yrs. Design D/man, industl. vacuum & conveying. At present Contracts Engr., Design & mnfrs. rotary louvre dryers. Seeks post as **TECHNICAL REPRESENTATIVE.** London. £1,000 p.a.

Ref. B.270. British. Male. Married. Age 29. H.N.C. (Mech. Eng.) with endorsements Theory of structures & Industl. Administration. Grad.I. Struct. Engr. 14 yrs. Apprentice to Senr. D/man, mech. handling engrs. At present Section Leader Design D/man, mech. handling engrs. Seeks post as **TECHNICAL REPRESENTATIVE**, based on Nottingham area.

Ref. B.272. British. Male. Married. Age 40. O.N.C. & H.N.C. Mech. Engg. with Industl. Administration. A.M.I.Mech.E. 5 yrs. Apprentice, large diesel engines. 4 yrs. D/man, free piston gasifiers. 6 yrs. Designer, hydraulic fuel systems for jet engines. 3 yrs. Chief Designer, small gas turbines & turbine cars. 2 yrs. Senr. Project Designer, advanced power units for commercial transport. At present Assistant Chief Engr., design & devpt. division—gears, gearboxes, motor cars, tractors, m/c tools. Exper. Free Piston Gas Generators, Automatic Transmissions, Marine gearboxes—hydraulics & heavy earth moving equipt. Seeks post as **CHIEF ENGR./ASST. CHIEF ENGR., OR SIMILAR.** U.K.—not N.E. England or Scotland. £2,000 p.a. min.

Ref. B.273. British. Male. Married. Age 38. O.N.C. Chem. O.N.C. & H.N.C. Elect. Eng., Final C. & G. Elect. Eng. A.M.Inst.W.S. 10 yrs. Lab. Asst./Methods Engr. 4 yrs. Head of W.S. Dept., and 1 yr. Prod. Engr., electric lamp mnfr. At present Prod. Engr. plastic & fancy box works. Seeks post as **WORK STUDY ENGR.**—not London—£1,150 p.a.

Ref. B.274. British. Male. Single. Age 23. H.N.C. Mech. Eng. with endorsements. S.M.I.Mech.E. 5 yrs. Apprentice, medium genl. engg. At present D/man, mnfr. air compressors & pneumatic tools. Seeks post as **MECH. ENGR. OR** D/MAN. abroad. £1,100 p.a. approx.

Ref. B.275. British. Male. Married. Age 38. 9 yrs. Apprentice & Motor Engr., retail garage. 5 yrs. Motor Engr., garage. 5 yrs. Engr. i/c of Vehicle Fleet, hospital group garages. At present Superintendent Inspector (Mech.), Mech. Branch of Public Works Dept., abroad. Seeks permanent post as **GARAGE SERVICE MANAGER OR PLANT DEPOT MANAGER.** Abroad. £1,750 p.a.

Ref. B.277. British. Male. Married. Age 28. C. & G. (Workshop). 4 yrs. Foreman, paper mill Engrs. 2 yrs. 3rd Engr., marine engg. 2 yrs. Engr., pump specialist, food m/cy engrs. 2 yrs. with Consultant Engrs. abroad i/c maintenance & m/c shops. Seeks post as **Service Maintenance Engr./Mech. Engr.** abroad. £1,500 p.a.

Ref. B.278. British. Male. Married. Age 30. H.N.C. (Mech. Eng.). 5 yrs. Student/ & 2 yrs. Planning Engr., high speed packing m/cy. 1 yr. Asst. Prod. Controller, m/cy building. 6 mnths. Works Manager, mech. handling equipt. At present Works Manager, mnfr. mech. handling (hydraulic) equipt. Seeks post as **ASSISTANT WORKS MANAGER** with medium/large company. London or 10 mile radius Guildford. £1,600/£1,800 p.a.

Ref. B.279. British. Male. Married. Age 38. O.N.C. & H.N.C., Elect. Eng. & endorsement Radio Eng., Grad. I.E.E. 7 yrs. D/man, power station (elect.). 2 yrs. D/man & 12 yrs. Devpt. Engr., radio transmitters. At present Development Engr.—elec. & Mech.—devpt. of laundry equipt. Knowledge Jig & Tool Design & mech. work. Seeks post as **DEVELOPMENT ENGR.** London or Essex. £1,400 p.a.

Ref. B.280. British. Male. Single. Age 30. H.N.C. (Mech.). Grad.I.Mech.E. 3 yrs. Articled Pupil & 2 yrs. Chassis Design D/man, motor vehicle makers. At present Senr. Design D/man, vehicle mnfrs. Seeks post as **ENGR. OR DESIGNER.** Abroad—not Africa or Middle East—£1,200 p.a. min.

Ref. B.281. British. Male. Married. Age 40. O.N.C. (Elect.), A.M.I.Inst. Plant Eng., A.M.Inst.B.E. 4 yrs. Apprentice/Junr. Engr., hosiery & textiles. 6 yrs. Chief Elec. Artificer, R.N. 6 mnths. Fitter, brewers & flour millers. 3 yrs. Asst. to Chief Engr., hosiery & textiles. 10 yrs. Maintenance Engr., sawmilling—all wood processing. At present Senr. Maintenance Engr., sawmilling, plymills, wood mnfrs. Exper. preventive maintenance schemes, work study & modern management techniques, costing & toolroom procedure. Seeks post as **MAINTENANCE OR PLANT ENGR.** U.K. £1,500 p.a. min.

Ref. B.282. British. Male. Married. Age 33. O.N.C. (Mech.). 5 yrs. Apprentice, m/c tool mnfr. 1½ yrs. Fitter, tool room, food prod. m/cy. 1 yr. Rate Fixer & 5 yrs. D/man, mnfr. 9 mnths. D/man, diesel engines. At present Section Leader Design. D.O., domestic appliance mnfr Seeks post as **ENGR. OR ASSIST. CHIEF/CHIEF D/MAN.** U.K.—pref. Home Counties or S. coast England—or Western U.S.A. £1,300/£1,500 p.a.

Ref. B.283. British. Male. Married. Age 34. Cert. equiv. to H.N.C., A.M.I. Plant E. 1½ yrs. Asst. Mech. Engr., oil company. 1 yr. D/man, aircraft mnfrs. 9 yrs. Mech. Engr., civil engg. contractors. At present Mech. Engr., civil engg. contractors. Seeks post as **MECH. ENGR.** London—N. London pref. £1,200 p.a.

Ref. B.259. Irish. Irish. Male. Married. Age 30. Inter B.Sc. & Taking Final Dip. Tech. exam. March. Exper. includes 4 yrs. Laboratory Technician, oil refinery. At present Sandwich Apprentice, oil refinery. Seeks post as **ENGR. B.W.I.** £1,000 p.a.

Ref. B.284. British. Male. Married. Age 47. Diploma in Mech. Engg. 3½ yrs. Steam Engr., engrs. 3 yrs. Turbine Engr., engg. concern. 3½ yrs. Lubrication Engr., & 5 yrs. Tech. Sales Engr., oil company. 1 yr. Senr. Equipt. Engr., oil refinery contractors. At present Senr. Project Engr., oil refinery & steam contractors. Fluent French & German (incldg. Technical), some Italian. Several years exper. in Europe as Sales Engr. Seeks post as **EXPORT SALES ENGR.**, pref. London based with overseas travel. £2,000 p.a. min.

Ref. B.285. British. Male. Single. Age 29. B.Sc. (Eng.) Mech., Grad. I. Mech. E. Dip. B.I.M. 1½ yrs. post Grad. Trainee, genl. engg. 2 yrs. Materials Controller & Asst. Prod. Controller, nuclear contro equipt. At present Project Design Engr., steam rating equipt. Seeks **TECHNICAL ADMINISTRATION OR SALES POST.** Pref. Portsmouth area —abroad considered. £1,250 p.a.

Ref. B.287. British. Male. Married. Age 52. 6 yrs. Apprentice, engr. 3 yrs. Asst. Manager. engrs. 20 yrs. Supervisor, telephone & elec. engrs. At present Group Supervisor, telephone & elec. engrs. Exper. dwg., planning, ratefixing, stores control, fitting, tool making, power presses, spot & arc welding, milling, capstan lathes, sheet metal work, jig & fixture design. Seeks post as **SUPERVISOR (ENGG.).** U.K. £800 p.a.

Ref. B.288. British. Male. Single. Age 27. H.N.C. Elec. Engg. 5 yrs. Apprentice & 3½ yrs. D/man, mnfrs. of rotating elec. m/cs. At present D/man, mnfrs. special convection-conveyor ovens for plant bakeries. Seeks post as **TECH. REPRESENTATIVE OR COMMISSIONING ENGR. (ELEC.).** £800 p.a. min.

Ref. B.290. British. Male. Married. Age 50. Engine/Boiler RM Cert. 15 yrs. R.N. 2 yrs. Supervisory Engr., War Dept. 1½ yrs. Power House Engr., refinery. 2 yrs. Station Engr. (Mech.), govt. work. 1 yr. Shift Charge Engr., commercial elec. power concern abroad. At present Plant Operator, nuclear power. Seeks **PERMANENT POST IN ENGINEERING**—anything considered S.W. England or Western Hemisphere.

Ref. B.291. British. Male. Single. Age 30. B.Sc. (Eng.). A.M.I.C.E., A.M.I.Mun.E., A.M.Inst.H.E. 3½ yrs. Asst. Engr., civil engg. 3½ yrs. Civil Engr., civil engg. & building. At present on leave after 3 yrs. contract with P.W.D. abroad. Consid. exper. roads, bridges, sewers, water supplies, R.C. structures—design & construction & in managing a quarry. Seeks post as **CIVIL ENG.** U.K. or abroad. £1,800-£2,000 p.a.

Ref. B.293. British. Male. Married. Age 35. H.N.C. Engg., A.M.I.Mech.E. 5 yrs. Apprentice, 2 yrs. Tech. Asst., 2½ yrs. Asst. Managing Director, 2½ yrs. Service Manager & 5 yrs. Genl. Manager, mnfg. engrs. At present Genl. Manager, engrs. Wide exper. mech. engg., especially as applied to civil engg. Seeks **ENGG. OR GENL. MANAGEMENT** post. London or Kent. £2,250 p.a.

Ref. B.294. British. Male. Married. Age 34. O.N.C., H.N.C. (Mech.), A.M.I.Mech.E. 4 yrs. Works Apprentice, gauge & tool makers. 4 yrs. Detail D/man, light m/c tool & optical instrument makers. 1½ yrs. Detail D/man, automobile & genl. light engrs. 1½ yrs. Design D/man, chem. & petroleum plant mnfrs. 5 yrs. Senr. Designer, design & devpt. engrs. (contract design office). At present Senior Designer (Mech.), mnfrs. oxygen cutting profiling m/cs. Seeks post as **ASST. CHIEF D/MAN, SECTION LEADER OR TECH. LIAISON ENGR.** Central London or Southern Home Counties. £1,250 p.a. approx.

Ref. B.295. British. Male. Married. Age 30. 7 yrs. Apprentice & Electrician, elec. engrs. 2 yrs. Foreman Electrician & 2 yrs. Foreman (Staff), elec. contractors. 1½ yrs. Engr., elec. engrs. At present Elec. Engr. (Construction), construction engrs. & boilermakers. Seeks post as **ELEC. ENGR.** U.K. (not London) or abroad. U.K. salary £1,200 p.a.

Ref. B.296. British. Male. Married. Age 34. B.Sc. (Horticulture). 2 yrs. Milk Tester, milk products mnfrs. 1 yr. Nurseryman, gaining practical exper. in horticulture. 1½ yrs. Advisory Officer (Research), advisory & research service. 1½ yrs. Field Asst., tropical agriculture (bananas). At present Sugar Agronomist, sugar cane cultivation. Exper. field experimentation & of soil analysis & foliar diagnostic work in laboratory & of statistical analysis of experiment data. Seeks post as **AGRONOMIST.** U.K. or abroad—Commonwealth pref. £1,500 p.a.

Ref. B.297. British. Male. Married. Age 25. Final C. & G., Jig & Tool D/man Diploma. 6 yrs. Apprentice. 3 yrs. Fitter, coal board. At present D/man, electro-mech. circuit breakers. Knowledge of Press Tools. Seeks post as **WORKSHOP INSTRUCTOR OR D/MAN**, abroad.

Ref. B.300. British. Male. Married. Age 35. O.N.C. Parts 1 & 2 in Mech. & Elec. 5 yrs. Pupil D/man, engg. 5 yrs. Surveying Asst., river board. 3 yrs. Chief D/man/Asst. Engr., food factory. At present Resident Engr., nuclear power station construction. Seeks post as **WORKS MANAGER (SMALL PLANTS) OR PUBLIC RELATIONS (ENGR.).** U.K. £1,400 p.a.

Ref. B.301. British. Male. Married. Age 31. H.N.C. (Mech.) & endorsements. Grad.I.Mech.E. 7½ yrs. Apprentice & D/man, locomotive engrs. 6 mnths D/man, power press mnfr. 3 yrs. D/man & 4 yrs. Senior Design D/man, aero engine mnfrs. At present Senr. Design D/man, aero engines, gas turbines. Seeks post as **MECH. ENGR.** within 20-mile radius Derby. £1,200 p.a. min.

Ref. B.302. British. Male. Married. Age 37. B.Sc.(Eng.) (1st Hons.). A.M.I.C.E. 13 yrs. Asst. Engr., consulting engrs. (civil). 6 mnths. Engg. Asst., local water authority. At present Senr. Asst. Engr., electricity supply. Exper. covers investigation & supervision of civil engg. works mainly hydro-electric. Seeks **CIVIL ENGG. POST** in hydro-elec. engg., water supply, irrigation or sewerage. U.K. £1,700 p.a.

Ref. B.303. Indian. Male. Married. Age 37. **RESIDENT AFRICA.** B.Sc.(Chem.). 12 yrs. Prod. Chemist & 2 yrs. Asst. Works Manager, oil mill, refinery & hydrogenation, soap & detergents & margarine, in India & Africa. Seeks post as **WORKS/ASST. WORKS/PROD. MANAGER.** U.K., Commonwealth, Australia or U.S.A. £2,500 p.a.

Ref. B.305. British. Male. Married. Age 38. Diploma Agriculture & Diploma Tropical Agriculture. 2 yrs. Farm Pupil. 6 yrs. Tenant Farmer. 5 yrs. Agricultural Officer, abroad, mainly engaged in agricultural extension advisory work. Seeks **ADVISORY/SALES/ADMINISTRATION** post. U.K. or abroad. £1,200 p.a.

Ref. B.307. Polish. Male. Married. **RESIDENT** U.K. Age 25. Diploma in Chem. Engg. At present Devpt. Engr. electrolytic capacitors. Seeks post as **CHEM. ENGR. (PROCESS, DEVPT. OR RESEARCH).** London or S. England. £875 p.a.

Ref. B.308. British. Male. Married. Age 25. O.N.C. (Mech.). S.M.Inst.Works Managers. 5 yrs. Indentured Apprentice, 1½ yrs. Planning & Work Study Engr. & 1 yr. Estimating Engr., electronic & fuel injection equipt. 1 yr. Estimating & Cost Reduction Engr., motor accessories. At present Work Study & Methods Engr., mnfrs. motor accessories. Has taken course on Work Study. Seeks post as **ASST. WORKS MANAGER OR CHIEF ESTIMATOR.** Outer London (pref. N. London). £1,300 p.a. approx.

Ref. B.310. Egyptian. Male. Married. Age 40 **PERMANENT RESIDENT U.K.** Tech. Diploma equivalent H.N.C. 5 yrs. Marine Engr., shipping. 2 yrs. Engr. i/c, rice milling. 5 yrs. Head of Fatty Alcohols Dept., chem. products mnfrs. 3 yrs. Works Sup. Eng., ice prod. & cold storage. Seeks **MECH. ENGG.** post—**PREF. AS MAINTENANCE OR SHIFT ENGR.** U.K. £1,200 p.a.



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